The FOUNDRY

Volume 53
Number 22

Published
Semimonthly

CLEVELAND, OHIO, NOVEMBER 15, 1925

Cast Standards Hold Lights for City's Safety

CONGESTED traffic conditions, the necessity for combating the increasing crime wave, and the rapid trend toward beautification of urban centers, all have combined to stimulate the installation of street lighting systems on an extensive scale. Dark streets with a lone flickering lamp suspended from a pole at street intersections rapidly are passing. Now artistic standards which harmonize with sur-

Safety to Pedestrian and Motorist Is Secured Through Evenly Disfributed Light

roundings, holding lamps which literally flood the thoroughfare with light, are increasingly favored. Castings play an important part in the white way installations, one type of standard being made entirely of cast gray iron, and another of cast iron and fabricated steel parts. New York has approximately 26,000 ornamental iron lamp-posts scattered throughout the city, about 10,000 being all cast iron and 16,000 having steel pipe shafts with ornamental cast iron pedestals. Cleveland has in the neighborhood of 3500 metal standards. That city recently installed a new lighting system on Superior avenue between Twelfth and Fifty-fifth streets, 214 combination type standards being used. Cast iron parts include the lantern base, neck, capital and band, column base, fluted base and lower base members, the total weight of castings for one post being 311 pounds, while approximately 33 tons of cast parts were used on the entire job.

Find Where Castings Can Be Sold

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PUBLISHED BY THE PENTON PUBLISHING CO., CLEVELAND, O.

BRANCH OFFICES

BOSTON ..... 1037 Old South Bldg.
CHICAGO ..... 1147 People's Gas Bldg.
CINCINNATI ..... 408 Edwards Bldg.
NEW YORK ..... 2203-2206 No. 220 Broadway
PITTSBURGH ..... 2148-49 Oliver Bldg.
SAN FRANCISCO ..... 24 California Street
WASHINGTON, D. C. ..... 401 Westory Bldg.

FOREIGN OFFICES

BIRMINGHAM, ENGLAND ..... Prince's Chambers
LONDON, ENGLAND ..... 2-3 Caxton House Westminster, S.W.I.
PARIS, FRANCE ..... 23 Rue de la Bienfaisance VIIIe

Cable address, IROTRAPEN, London

SUBSCRIPTION

United States and Mexico ..... $3.00 a year
Canada ..... $4.00 a year
Great Britain and other Foreign Countries ..... £1:0:0 a year
Single Copies ..... 25 cents

Copies published three months or more previous to date of current issue, 50 cents each

Member, Audit Bureau of Circulations, Associated Business Papers, Inc., National Publishers Association

Entered at the Post Office at Cleveland as Second Class Matter

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Inaccuracies Shown

EXPERIENCE has convinced me that no useful purpose is served by a prolonged discussion by two persons who hold diametrically opposing views over a debatable subject. This is particularly true when the discussion is carried on at long distance through the medium of the printed page. Statements that are submitted in all sincerity by one party sometimes are misconstrued by the other and the result is satisfactory neither to the reader nor the writer. Sometimes the misconstruction is unintentional, but at other times it is done deliberately for the purpose of scoring a point. The desire to win in any form of contest is so deeply ingrained in the average man that he will take liberties with the concrete which he is willing to roundly condemn in the abstract. He calmly ascribes motives to his competitor that never existed and has no scruples in quoting excerpts to prove a point which if taken with the context convey an entirely different meaning.

In a series of articles published in The Foundry, Feb. 15, March 1, and March 15 the writer who is a plain, old-fashioned foundryman set forth views on the relationship between the foundryman and the purchasing agent. He stated quite plainly that there are two sides to every question. He also stated that broad general characterizations must be accepted with a grain of salt. Finally, he stated that in every class an unsavory reputation frequently is gained through the action of a comparatively small number of individuals.

The series of articles was based entirely on these premises and no imputation concealed or otherwise was leveled at the large number of purchasing agents who are thoroughly competent, familiar with market and manufacturing conditions and who are actuated by sincere and honest motives in their dealing with their fellow man. The motive behind the series of articles was to direct attention to a condition that existed due to the presence in the purchasing field of men who are not competent either through natural qualifications training or experience properly to discharge the duties of their office.

Surely no sensible person will deny that the foundryman has a legitimate grievance when business conditions force him to carry on negotiations with a man, who thinks by day and dreams by night of schemes whereby he can put one over on the foundryman. When he must sell his product to one who does not know and does not care how castings are made, but who is willing, nay anxious to use every trick and every artifice, legitimate and illegitmate to screw castings out of a foundryman at a minimum price. When he must barter with a person whose consuming ambition is to buy below the market and who considers it a personal triumph a subject for congratulation and something about which he can boast when he learns directly or indirectly that he is securing castings below the actual cost of production.

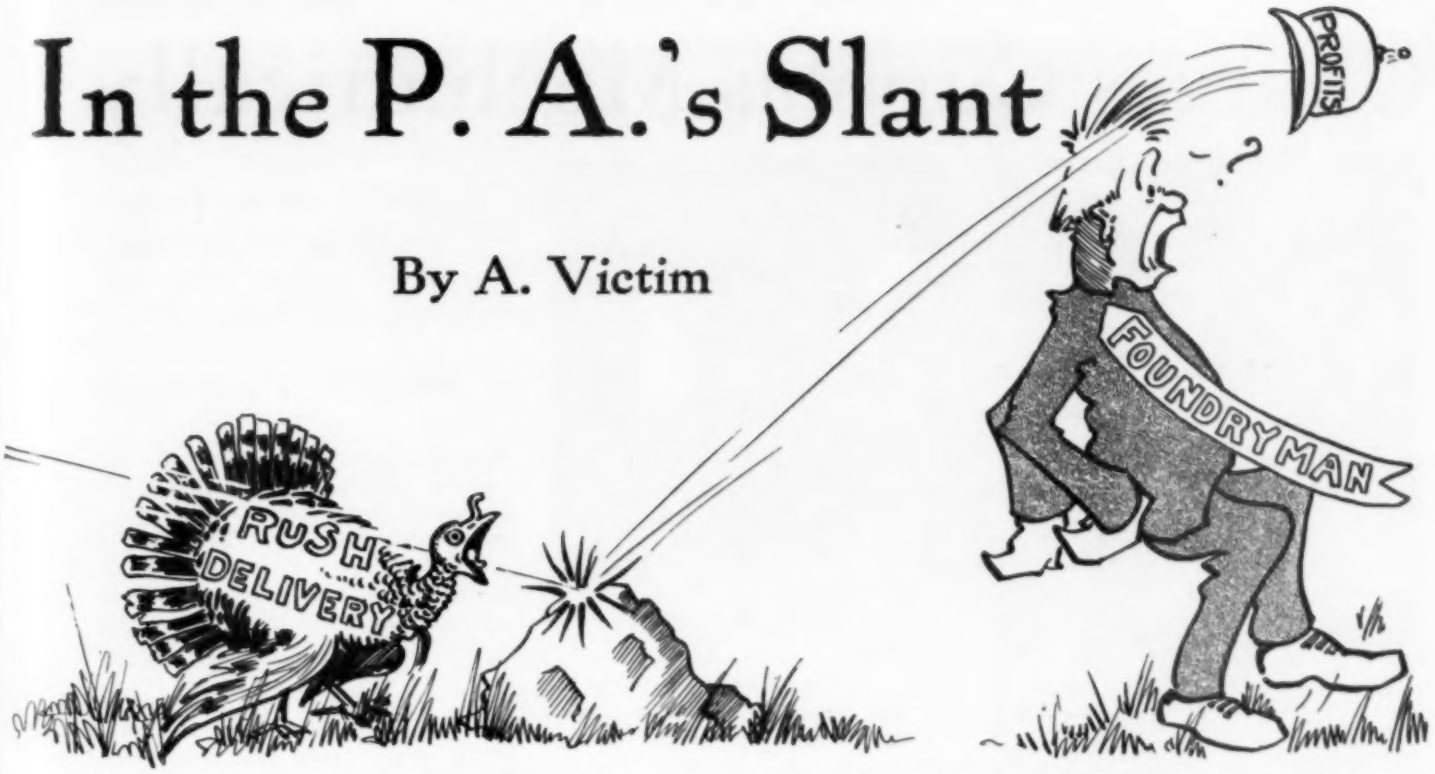
Calmly ignoring the fundamental basis on which the articles were predicated John C. Dinsmore, vice president of the National Purchasing Agent's association takes up his trusty cudgel and proceeds to lay around him right lustily in the July 15, Aug. 1 and Aug. 15 issues of THE FOUNDRY. According to his view the purchasing

Viewpoints Vary

IN THIS and a series of three articles which appeared in THE FOUNDRY, *Feb.* 15, *March* 1 *and March* 15 *a foundryman of wide experience who prefers to conceal his identity under the pseudonym, A Victim, directs attention to several of the underlying causes of friction between the purchasing agent and the man who sells castings. These articles were written from the foundryman's standpoint and drew a spirited defense from John C. Dinsmore, vice president, National Association of Purchasing Agents. The present article is presented in rebuttal. The entire series has attracted considerable attention and the editors will welcome comment from readers who are interested.*

In the P. A.'s Slant

By A. Victim



agent singly and *en masse* is the salt of the earth, the pivot around which the business world revolves. He is a composite of the Three Wise Men from the East and the man who put the salt in the sea to keep it fresh. He sees all things, hears all things and knows all things. He can read foundrymen like an open book printed in two colors in large type and in words of one syllable. He smiles indulgently at their deep laid and crafty schemes to sell castings at a profit and explains kindly that he knows best what price is good for them.

To offset this we read:

To the unbiased reader it would appear that the chief difficulties encountered by A Victim in selling castings to purchasing agents lies in his own ignorance, lack of cost and competition data and his prejudice against the whole tribe of purchasing agents. What he needs apparently is more accurate knowledge concerning his own product, his own costs and a course in the psychology of selling. First of all he must be sincere and possess a genuine desire to serve the customer, the purchasing agent. Next he must convince the purchasing agent of his knowledge and his sincerity and his desire to serve.

In one of the original articles I admitted that many foundrymen were not familiar with their production costs, but I fail to see how a course in psychology of selling would benefit them. At best it would only be acquired and would avail them nothing against the purchasing agent who according to Mr. Dinsmore's modest claim is a natural born psychologist. In a pitched battle between an amateur psychologist and one who not only is born that way but also highly trained, the poor foundryman would make even a poorer showing than he does under present conditions.

Favors Unit Price

THE following pertinent comment on the practice of buying castings by the individual piece instead of on the average pound basis appears in The Purchasing Agent *for October. The one quoted is Harold A. Russell, purchasing agent, A. B. Farquhar Co., Ltd., York, Pa. His observations follow:*

*In the writer's judgment, the price basis can more fairly be arrived at by considering each pattern as a separate unit. It is easier for the buyer to more clearly determine his costs. When a flat price per pound is quoted on the buyer's requirements, for a year, it does not give the buyer a correct figure for cost.*****

In figuring cost of finished product, it would seem best to put into that cost the actual price per pound which was paid for the malleable casting, and not an average price. An average price simply means that some costs are receiving the benefit of too low a price, while other costs include a figure which is higher than it should be. Thus neither of the costs are correct.

I am willing to admit that the foundryman must be sincere and evince a genuine desire to serve the customer, in this instance represented by a purchasing agent. In fact I am in accord almost with the entire paragraph with the exception of the last sentence. "He must convince the purchasing agent of his knowledge and his sincerity and his desire to serve."

How under the shining dome of heaven can one person convince a second person of his knowledge of a subject of which the second person is ignorant? Would you ask a singer to give a voice demonstration before a deaf judge?

Based no doubt on an extended experience in buying castings Mr. Dinsmore has discovered that foundrymen without exception are a sore and disgruntled body who invariably go about with chips on their shoulders. In a truly pitiable attempt to dissemble they approach the sanctum of the purchasing agent, hat in hand and with bated breath and ingratiating smile beg to be allowed to bask in the smile of his benevolence to the extent of an order for a few castings.

This cloak of hypocrisy might serve in some places, but it affords no protection in the presence of an omnipotent being endowed with a marvelous sixth sense which enables him plainly to discern the chip on the shoulder and the craven spirit within the quaking frame. Says Mr. Dinsmore:

The attitude of the purchasing agent is the direct reaction caused by the true attitude of the salesman. The salesman in this case begins the interview without an open mind. He dislikes the whole tribe of purchasing agents and regards them as a necessary evil. While he has that thought

(*Concluded on Page* 936)

Charges Cupolas Mechanically

Electric Charging Device with One Operator Replaces Crew of Eight Men on Charging Platform

By William G. Hammerstrom

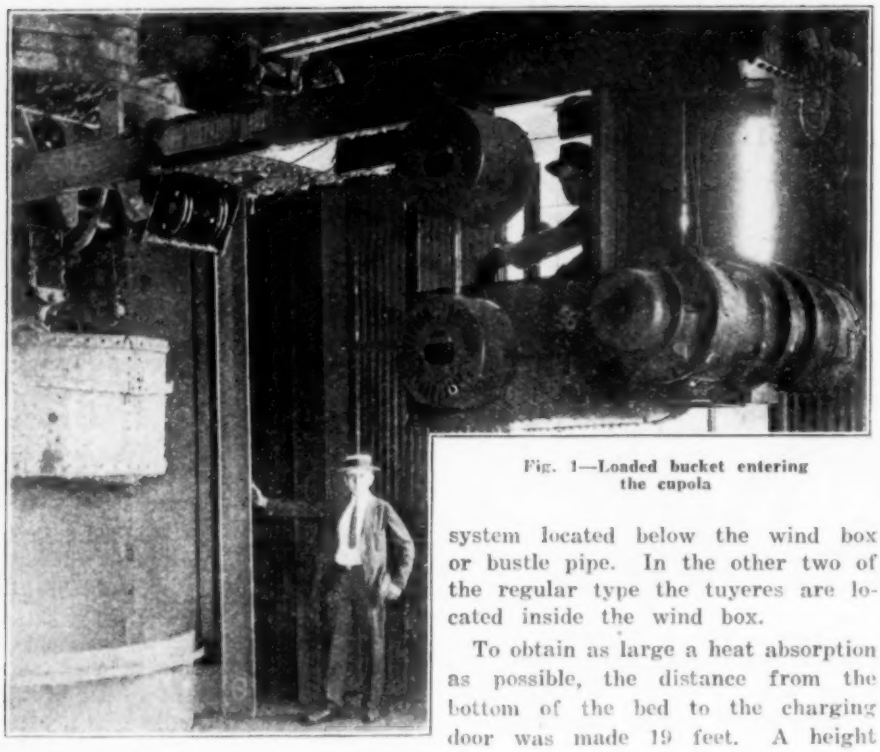


Fig. 1—Loaded bucket entering the cupola

MECHANICAL charging equipment recently installed at the Radford, Va., works of the Lynchburg Foundry Co., Lynchburg, Va., manufacturers of cast iron pipe, has removed all manual labor on the charging floor, with the exception of the crane operation.

Metal is melted in four 96-inch diameter shell cupolas lined down to 74 inches and made by the Whiting Corp., Harvey, Ill. Two of these cupolas are equipped with a tuyere system located below the wind box or bustle pipe. In the other two of the regular type the tuyeres are located inside the wind box.

To obtain as large a heat absorption as possible, the distance from the bottom of the bed to the charging door was made 19 feet. A height greater than this perhaps would not be justified since the cost of raising the material higher probably would offset any saving in the melting. The door opening was made 11 feet high to accommodate the charging equipment. An interior view of the cupola house taken from the charging floor, showing the four cupolas in position, is shown in Fig. 6.

The cupolas are served by two positive blowers made by P. H. and F. M. Roots Co., Connersville, Ind., and driven by 75-horsepower variable speed 220 volts, direct current motors. One of the units is belt driven and the other direct connected through a rope flexible coupling. To insure an abundant supply of fresh, clean air and as far as possible to prevent dust and dirt from entering the suction inlets, the blower units were installed in a separate room on the mezzanine floor. The motors are started and stopped by push bottom controllers placed within easy and quick reach of the operators on the ground. The motors are adapted to a speed variation from 625 to 1000 revolutions per minute.

Under ordinary conditions, the motors are run to give the blowers the rated speed of 170 revolutions per minute, producing a blast pressure from 12 to 14 ounces, and giving a melting result of about 20 tons of iron per hour for each cupola.

The cupolas are used in pairs on alternate days. While one pair is in operation, the second is made ready for the following day. A 30-inch diameter steel pipe header into which the blast is discharged is located parallel with the battery of cupolas. Four 24-inch diameter pipe connec-

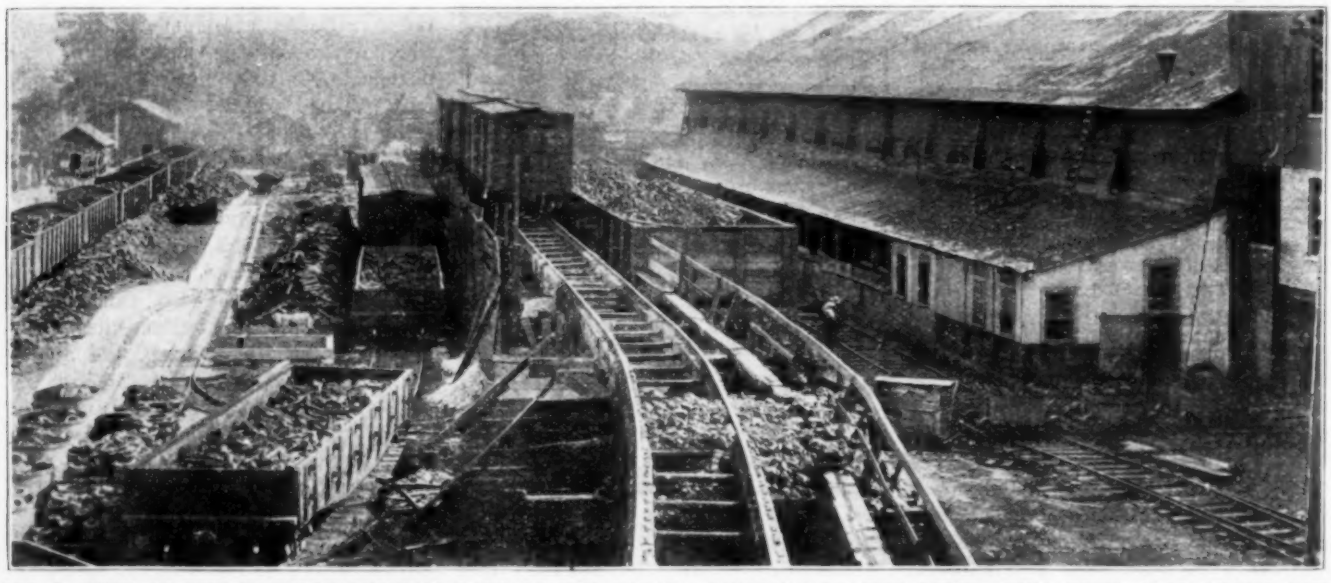


FIG. 2—VIEW OF PIPE FOUNDRY SHOWING PART OF THE CUPOLA BUILDING TO THE RIGHT. THIS VIEW ALSO SHOWS THE TRESTLE, COKE BIN, STORAGE YARD AND TRACKS. NOTE THREE BUCKETS READY TO ENTER THE CUPOLA HOUSE AND A SECOND LOT OF THREE READY TO BE PULLED INTO PLACE IN THE LOWER RIGHT CORNER

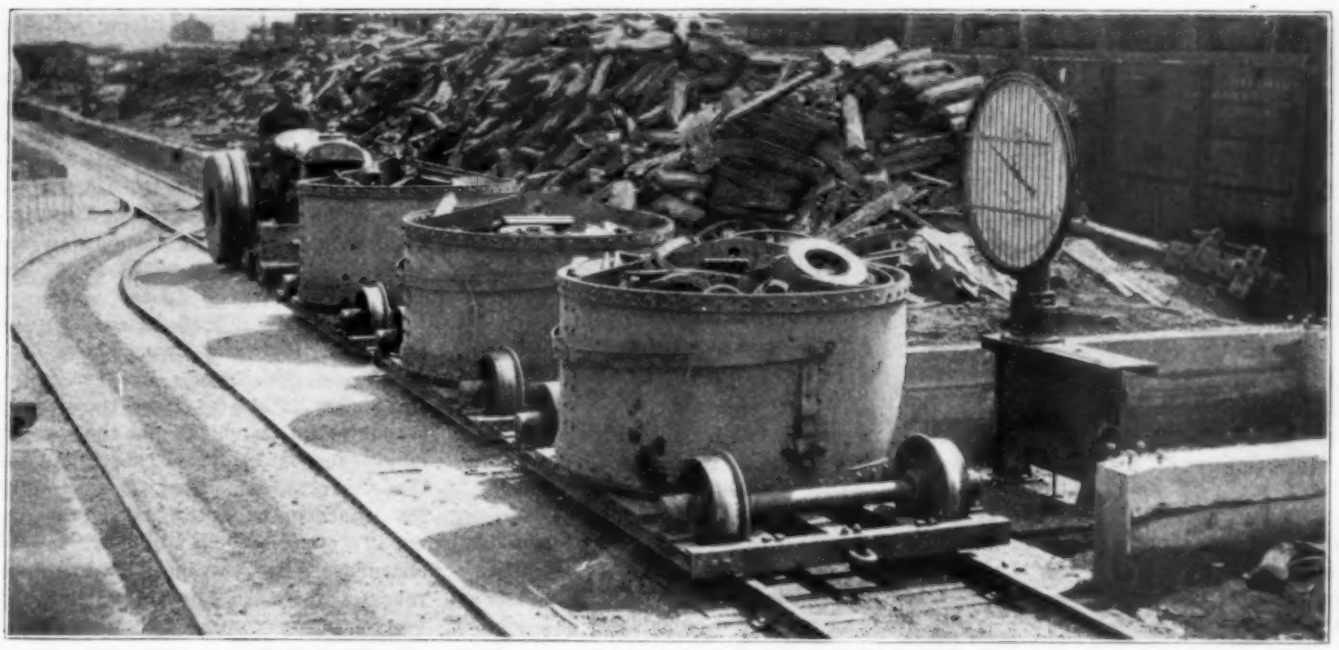


FIG. 3—BATTERY OF THREE LOADED BUCKETS READY FOR WEIGHING ON THE WAY TO THE CUPOLA. NOTE UNDERSLUNG CAR BODIES. A GASOLINE TRACTOR DOES THE NECESSARY SHUNTING

tions, one to each cupola, and each line carrying a valve close to the inlet connects the header with the wind boxes. A 30-inch valve is placed in the center of the header, and by this management of valves, any of the cupolas can be operated from any of the two blowers.

The cupolas are lined with 8-inch deep cupola block, and back bricks from the bottom up to within 30 inches of the charging door. From this point up to the tapered section of the cupola, cast iron bricks are used and the smaller section of the stack is lined with a 4½-inch deep refractory brick.

The charging device is an overhead crane of 30 feet span, traveling lengthways of the building on runways fastened to the columns of the steel structure. An 18-inch I beam serving as a monorail, on which the charger travels on double monorail trolleys is attached to the underside of the crane. The electrical equipment is made for a direct current of 220 volts. The crane and the charger are controlled by the operator in the cage. This equipment was built and furnished complete by the Shepard Electric Crane and Hoist Co., Montour Falls, New York.

Steel Charging Buckets

The charging buckets 4-feet 10 inches inside diameter and 2 feet 8 inches high also were built by the Shepard company. The bottom doors of these buckets are pivoted at the center line to open by the tripping of a latch controlled from the operator's cage. Each half of the door has two small rollers which aid in the closing and latching of the doors when the buckets are lowered on the floor. Each charge in the bucket is 4000 pounds in weight consisting of pig iron, scrap iron, and foundry returns. On the bottom of the bucket is placed 400 pounds of coke, which in addition to the weight of the bucket and the iron, make up the total hook load, somewhat less than the normal capacity of the 3 ton charger.

With a melting capacity of 40 tons per hour for the two cupolas and with each charge weighing 2 tons, the crane makes 20 trips per hour, or one trip every third minute to keep the charges at the proper level in the cupolas. The speeds of the charging equipment and the size of motors were designed to meet this condition. Actual operation has proved them quite ample.

A freight elevator, formerly used for elevating the material to the charging floor when hand charging was in vogue was installed in the lower corner of the building as a reserve in case of breakdown of the charging device.

Directly above the two 36-inch tracks leading into the cupola building from the yard, a hatchway 16 feet wide and 22 feet long, is provided in the charging floor, serving as a clear passage for the ascending and descending buckets. A railing is erected around this opening in the floor as a safety measure. Railroad

FIG. 4—THREE BUCKETS TAKING COKE

FIG. 5—A PULL ON THE LEVER LOADS THE BUCKET

FIG. 6—GENERAL VIEW ON CHARGING FLOOR SHOWING ONE BUCKET ABOUT TO ENTER THE LAST CUPOLA IN LINE

tracks in the yard include the 36-inch gage tracks leading from the cupola building to underneath the coke bin, making a semicircular turn at the end of the trestle into the iron stock yard, and finally terminating in the cupola building. Box cars carrying the 72-hour coke to the foundry are placed on the trestle where the coke is unloaded by hand into a coke bin 106 feet long, 14 feet wide and 6 feet 8 inches deep, constructed adjacent to the trestle.

To provide proper head room for the cars with the buckets under the coke bin, the floor is located about 8 feet above the ground and supported by suitable wood construction. Five cast iron hoppers spaced about 18 feet apart, each containing 400 pounds of coke or an exact amount for one charge are placed in the floor of the coke bin. These hoppers are equipped with curved sliding bottom doors which open by the straight downward pull of a lever, release the contents of the hopper and permit the coke to fall vertically into the empty bucket below. After the hoppers have been emptied, the doors close by gravity and the refilling with the coke is repeated. Part of the bin construction with the coke hoppers and cars below are shown in Figs. 4 and 5.

A general view of the tracks, yard, coke bin, and trestle is shown in Fig. 2. Pig iron is unloaded from the railroad cars into the yard by a locomotive crane and magnet. Special underslung cars for carrying the buckets were designed with just sufficient clearance over the rail to give a free passage. This was necessary to bring the top of the buckets below the waistline of the loaders and thus avoid excessive lifting of the material thrown into the buckets.

Charges are made up in the yard in batteries of three buckets, as shown in Fig. 3, transferred to the cupola house by a gasoline tractor and placed directly underneath the hatchway as shown in Fig. 8. This figure shows one of the buckets in the process of being hoisted from the car to the charging floor.

Another view, Fig. 7, taken from the from the charging floor shows the crane and the charger in position as the bucket is hoisted from the ground through the hatchway to the proper height for charging. From this position the crane is moved forward until the charger with the bucket is directly opposite the cupola to be charged. After this position has been reached, the crane proper remains at rest and the charger moves forward on the monorail toward the cupola until the center of the bucket has reached the center of the cupola as shown in Fig. 1. The charge is dropped by the tripping of the latch from the operator's cage, the two bottom door halves open and the contents of the bucket are deposited in the cupola. The empty bucket with the open doors then is withdrawn as the charger returns and as the bucket is lowered to the floor the doors close automatically. The crane returns to the position over the hatchway, the empty bucket is lowered and replaced on the car, and a similar operation repeated for each charge.

While the charger is occupied with three buckets, another battery of three is being loaded in the yard and by the time the last empty bucket has reached the ground, three newly filled buckets have reached the cupola house and are ready to be hoisted. Three sets of buckets constantly are in use; one empty set and one loaded set on the ground in the cupola house and a third set in the yard being loaded.

FIG. 8—GENERAL VIEW OF TRACKS AND PIPING ARRANGEMENT IN THE CUPOLA HOUSE AT THE BACK OF THE BATTERY OF FOUR CUPOLAS

FIG. 7—THE CRANE RUNNER IS THE ONLY MAN NEEDED ON THE CHARGING FLOOR. HE HAS JUST HOISTED THE BUCKET THROUGH THE OPENING IN THE FLOOR AND IS ABOUT TO PLACE IT IN THE CUPOLA

After the tractor has placed the loaded cars, the empty train is ready to be removed and returned to the yard underneath the bins where each bucket is given limestone and coke charges, and later pushed to the yard for the pig iron and scrap. Similar cycles of operation are repeated until the required amount of material has been charged to complete the day's run. Each charge is weighed before entering the cupola house on a track scale of the automatic dial type located in the lower end of the yard.

The cupola building 81 feet long and 51 feet wide is of steel construction, fireproof throughout. The charging floor is 22 feet above the ground and is covered entirely with plain steel plates.

Steam and gas escape through ventilators in the roof and through window sashes. The 13-inch brick walls between the steel columns extend up to the charging floor. Above the floor corrugated sheet iron replaces the brick. The mezzanine floor supporting the two blowers was made sufficiently strong and braced to take up any vibration from the running blowers and motors.

Making The Change

Prior to the erection of the new equipment four cupolas, two 72-inch, one 60-inch and one 42-inch were in operation. They were housed in an old structure with the blowers on the ground floor. Materials for the charge were raised to the charging floor by a motor driven elevator. Old construction and equipment were removed and new installation made by the company's own forces without the loss of a single day's run. The two old end cupolas were taken down first and new ones erected in their place. The other two old cupolas were run every day and put in shape every night for the following day's run. A portion of the old structure surrounding the two first cupolas also was taken down and replaced by new material. After the two new cupolas were made ready, the day's run was transferred to them and the remaining two old cupolas were removed and replaced by the other two new ones.

In a similar manner the building and auxiliary equipment were handled until the job was completed. The cost of this work showed figures a little above the ordinary on account of overtime, night work, and necessary rigging. However, the cost of a shutdown undoubtedly would have been higher.

Good charging usually is reflected in good distribution and no doubt many a foundryman has hesitated to install a mechanical charging system through the belief that no piece of mechanism for this particular duty can improve or even equal old fashioned hand charging. Many innovations perhaps have failed in the past just for this reason. However, charging by hand involves the many uncertainties of the human equation and since the job itself is not of the kind to draw the most desirable and dependable labor, hand charging necessarily does not insure perfection.

Results obtained by mechanical charging at the Radford Works have exceeded expectations.

Waste can flourish more unnoticeably in the foundry than in many manufacturing plants on account of the nature of the materials handled. Large pieces of iron readily are imbedded beyond vision in the ground; coke spreads easily over the surface and is crushed into powder by foot and wheel; sand and clay find their way undetected into pathways and roads. Conveyances used for transporting materials from place to place around the plant, open side cars and poorly constructed wagons, greatly promote waste. Part of the load falls to the ground and remains there. The charging buckets prevent waste of that kind. The load is entirely enclosed and cannot escape until it is dropped in the cupola.

The installation has proved a success from a monetary point of view in addition to obliterating one of the hardest tasks in the foundry. Formerly eight men were employed on the charging floor throwing in iron and coke. At present the crane runner is the only man actually engaged in charging the cupolas. The new method of handling iron, coke, and limestone on the ground floor also has eliminated several other heavy lifting jobs. From these visible results it is a money saver, a man saver and apparently the installation has proven a means for reducing waste.

Early Apprenticeship

By Robert E. Masters

During my foundry apprenticeship back in the sixties, I had sessions of breaking up pig iron, making up charges, charging and tapping the cupola, daubing the cupola and ladles, making up the loam, all interspersed with the work on the floor. In this way I obtained a thorough knowledge of all the details. The foreman also would have me measure up molds, some of them running into tons, and tell him the amount of iron that would be necessary to pour. At times he would have me take up the whole heat and attend to the details of taking off.

How many apprentices do these things today, or want to do them. I have known apprentices who take offense and feel humiliated on being asked to do the unpleasant tasks, and as a rule they never get far. Only a small percentage of journeymen molders even have a knowledge of anything beyond the floor, and they do not seem to care to go beyond. Without this broad knowledge, no man can make a successful superintendent of a foundry, one to whom the men will look up to and respect.

Pump Plunger Attacked By Mine Waters

Question: Triplex pumps are used in the mine here but due to the high acidity of the water handled the plungers of the pumps give short service. These plungers are made of cast iron but as they do not resist the effects of the bad water they are to be discarded for bronze plungers. Can you give us a formula for such an alloy?

Answer: It is a difficult matter to suggest a nonferrous mixture that will successfully withstand the corrosive and erosive action of highly acidulous mine water. The best known bronze mixture for such a purpose is made up of 90 per cent copper and 10 per cent tin. Stainless steel and porcelain now are being used to a great extent for making mine pumps plungers especially when the water is exceptionally bad.

Change Cupola Diameter

Question: Recently we purchased a cupola that is supposed to line up to 42 inches inside diameter. The volume of our work at present does not warrant the use of such a large cupola and we should like to line it down to 32 inches. We shall appreciate your advice on the proper size and distribution of the tuyeres for a cupola this size.

Answer: Make a pattern for a tuyere 4 inches high, 6 inches wide at the end near the shell of the cupola and 8 inches wide at the end near the coke and cast as many tuyeres as there are tuyere openings in the shell. Build the brick lining up as high as the lower edge of the tuyere openings in the shell and then adjust the tuyeres in place in the center and opposite each opening. The remainder of the wall is bricked in the usual manner with the inner wall built of bricks laid on edge standing up.

Correlating Gray Iron Tests-I

By John W. Bolton

MR. BOLTON, metallurgist, the Niles Tool Works Co., Hamilton, O., has been a frequent contributor to the technical press on the result of his investigations into gray iron metallography particularly on the effect of carbon in its many ramifications. At the Milwaukee convention of the American Foundrymen's association, 1924 he presented a paper on the advantages and limitations of the test bar.

HE WAS graduated from Rose Polytechnic institute, Terre Haute, Ind., in 1918 and shortly afterward joined the metallurgical staff of the Niles Tool Works to enter upon the work in which he has since continued with marked success. On June 11 this year Mr. Bolton was awarded the advanced degree of master of science by his alma mater. He is first vice president of the Cincinnati chapter of the American Chemical society.

A FUNDAMENTAL problem in the gray iron field is the correlation of knowledge of the constitution of gray iron to what is known about iron's engineering properties. Only by such correlation will the data of testing and research attain practical value. An outline of the existing relationships offers a logical foundation on which further investigation can be based.

In many tests, especially tests of mechanical properties, the exact condition of the metal used was not determined. As a result, numerous unexplained discrepancies detract from the practical value of such work. Today the methods of physical metallurgy furnish means for more thorough study.

Service of gray iron depends largely on its strength and resistance to wear. From the manufacturing viewpoint, cost, ease of casting, machinability, and appearance are important. The best measure of the true worth of an iron is its performance in actual service. Direct experimental work rarely is done by means of tests under actual working conditions. The cost of such experiments often is prohibitive and the time required is so long that the work may be obsolete long before completion. The engineer depends on simpler and quicker tests which furnish him an idea of comparative properties from which he can deduce the probable values of the different materials when in actual service. In course of time he is enabled to check these deductions against the performance of the material under actual service conditions.

From the American Foundrymen's association annual exchange paper presented before the Paris meeting of the Belgian and French foundrymen's associations, Paris, Oct. 25, 1925. Mr. Bolton is metallurgist at the Niles Tool Works, Hamilton, O.

Common Tests

The following outline gives some of the more commonly used tests for gray irons:

A—*Strength*
1. Static
   (a) Transverse (and Deflection)
   (b) Tensile
   (c) Shear
   (d) Crushing
2. Dynamic
   (a) Impact
   (b) Fatigue

B—*Hardness*
1. Resist indentation
   (a) Brinell
   (b) Rockwell
2. Rebound
   (a) Shore scleroscope
3. Scratch
   (a) Diamond point
   (b) Relief polishing

C—*Constitution*
1. Ultimate chemical analysis
2. Structural tests
   (a) Macroscopic
   (b) Microscopic
   (c) Ultra microscopic

This list can be extended indefinitely. For example, we have drill tests, chill tests, shrinkage tests, fracture tests, tests on volume changes, electric and magnetic properties tests, thermal tests, X-ray tests, corrosion tests, etc.

This paper is limited to consideration of some of the more common mechanical tests, the related engineering properties and to the correlation of these tests to observations on the structure of gray iron. A general conclusion advanced is that the parts of which it is made and the way they are put together determine the performance of a piece of metal. As a generalism this will not be denied. It is the structural viewpoint.

A second conclusion—also agreed on by most metallurgists—is that the condition of the carbon determines the properties of the metal.

The third thought advanced is that the properties of the casting can be predicted from the properties of the bar. Throughout this paper, emphasis is laid on how the various phenomena come about. To avoid complexity the number of variables directly considered has been made as small as possible. For this reason only the elements silicon and carbon are charted.

Transverse strength of gray iron depends on amount and distribution of graphite; degree of graphitization; condition of the combined carbon; general grain size including graphite size. These are determined largely by per cent total carbon; cooling rate; silicon and other elements.

Fig. 3 shows relation of per cent total carbon to the transverse strength of several irons with other elements approximately constant as determined on the A. S. T. M. standard bar. Fig. 4 shows relation of per cent total carbon to the transverse strength of several irons as determined on bars 2 inches in diameter. Fig. 5 shows the percentage strength changes on the two size bars due change in total carbon.

It is evident that for the irons

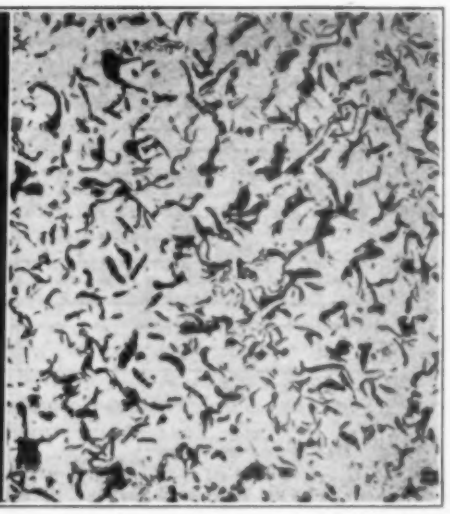


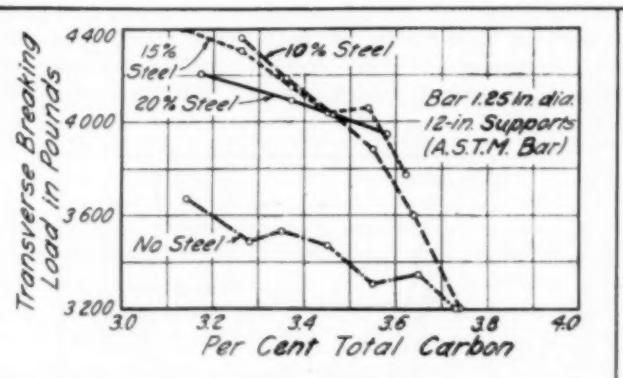
FIG. 1—GRAPHITE FLAKE SHOWING NETWORK. MAGNIFIED 850 DIAMETERS. POLISHED. FIG. 2—STRUCTURE OF AN IRON WHICH REGISTERED 5600 POUNDS ON STANDARD TRANSVERSE SQUARE INCH A. S. T. M. TEST BAR. UNETCHED

considered—more graphitization and greater grain size—the total carbon has greater influence in the heavier bars. Cooling rate depends largely on the relationships between surface and volume, initial temperature, thermal reactions within the metal, conductivity of surrounding medium and the room temperature. Of these, the relationships between surface and volume are most widely variant, hence section size is the most significant factor influencing cooling rate. Fig. 6 shows an actual cooling rate curve.

From these considerations, it is evident that increase in graphite causes decrease in strength and the tenacity of the metal is lowered by inclusion of a greater amount of this weak component.

Since the paths of the flakes so nearly are continuous throughout the metal, and since the graphite itself is noncoherent, assumption of network within the flakes is a plausible theory which accounts for the considerable strength of gray iron, Fig. 1. The idea of a ferrite network first was advanced by Prof. H. M. Howe. The author has examined the flake structures carefully. Nearly all are scooped out in the polishing operation, Fig. 1. In many cases close observation reveals a bright network appearance which suggests ferrite. Occasionally globules of manganese sulphide are contained within the flakes.

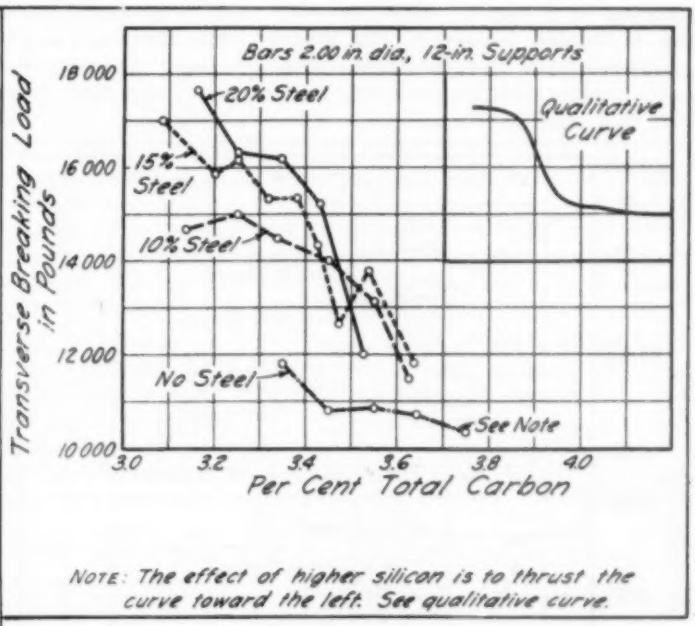
Graphite flakes occur in segregations of either the whorl or dendritic types, according to the composition of the metal. While the individual grains of the whorl may be tiny, whorl formations break up the continuity of the metal quite effectively. For this reason decrease in strength with increase in carbon usually is more marked in the higher carbon ranges. Sometimes an iron is found similar to that shown in Fig. 2 which possesses uniform graphite distribution and whose strength may



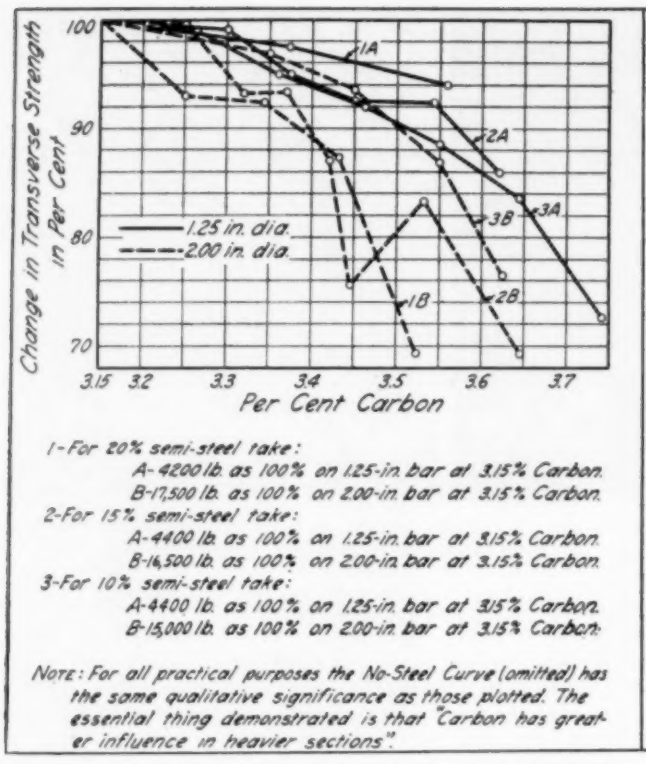
Total Carbon Per Cent	Average Silicon Per Cent	Transverse Breaking Load-lb
20-25% Semi-Steel, (88 Bars Tested)		
3.17	About 1.30	4205
3.37		4090
3.58		3945
15% Steel, (135 Bars Tested)		
3.13	About 1.50	4400
3.26		4305
3.36		4180
3.45		4040
3.54		4060
3.62		3780

Total Carbon Per Cent	Average Silicon Per Cent	Transverse Breaking Load-lb.
10% Steel-(111 Bars Tested)		
3.26	About 1.65	4360
3.37		4150
3.46		4035
3.55		3880
3.64		3600
3.74		3200
No Steel, (211 Bars Tested)		
3.14	About 1.75	3672
3.28		3490
3.35		3535
3.45		3470
3.55		3305
3.65		3345
3.73		3205

FIG. 3—EFFECT OF TOTAL CARBON CONTENT ON THE TRANSVERSE STRENGTH OF AMERICAN SOCIETY OF TESTING MATERIALS STANDARD TEST BAR. FIG. 4—EFFECT OF TOTAL CARBON CONTENT ON THE TRANSVERSE STRENGTH OF A 2-INCH TEST BAR



NOTE: The effect of higher silicon is to thrust the curve toward the left. See qualitative curve.


Change in Transverse Strength in Per Cent
Per Cent Carbon
1A
2A
3A
3B
2B
1B
1.25 in. dia.
2.00 in. dia.
1-For 20% semi-steel take:
A-4200 lb. as 100% on 1.25-in. bar at 3.15% Carbon.
B-17,500 lb. as 100% on 2.00-in. bar at 3.15% Carbon.
2-For 15% semi-steel take:
A-4400 lb. as 100% on 1.25-in. bar at 3.15% Carbon.
B-16,500 lb. as 100% on 2.00-in. bar at 3.15% Carbon.
3-For 10% semi-steel take:
A-4400 lb. as 100% on 1.25-in. bar at 3.15% Carbon.
B-15,000 lb. as 100% on 2.00-in. bar at 3.15% Carbon.
Note: For all practical purposes the No-Steel Curve (omitted) has the same qualitative significance as those plotted. The essential thing demonstrated is that "Carbon has greater influence in heavier sections".

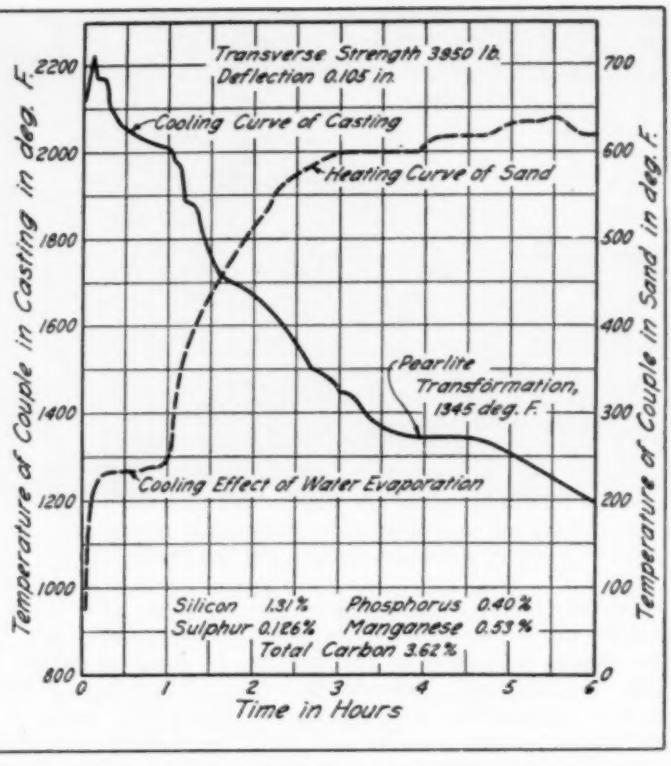
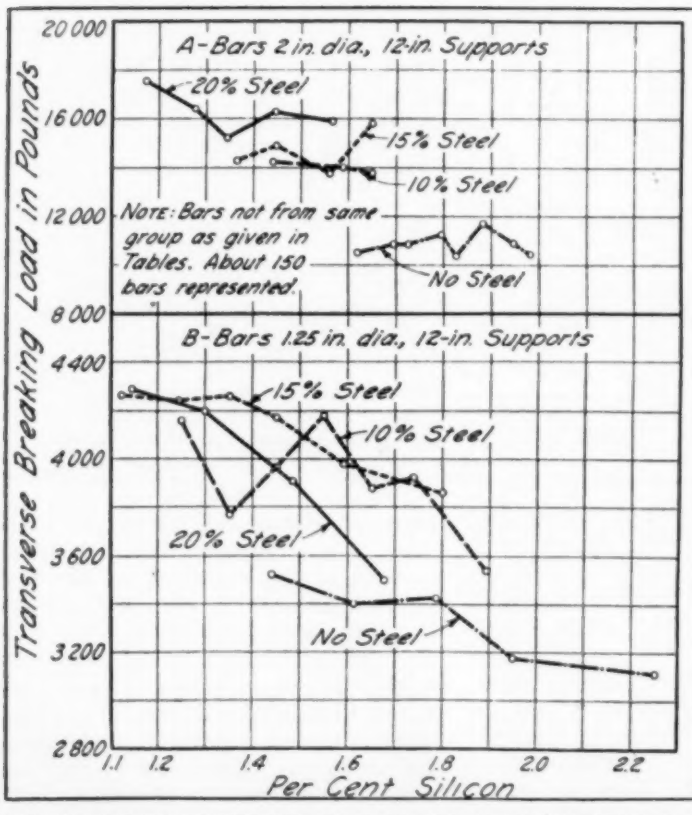

Temperature of Couple in Casting in deg. F.
Temperature of Couple in Sand in deg. F.
Time in Hours
Transverse Strength 3950 lb.
Deflection 0.105 in.
Cooling Curve of Casting
Heating Curve of Sand
Pearlite Transformation, 1345 deg. F.
Cooling Effect of Water Evaporation
Silicon 1.31% Phosphorus 0.40%
Sulphur 0.126% Manganese 0.53%
Total Carbon 3.62%

FIG. 5—ILLUSTRATING PER CENT CHANGE IN TRANSVERSE STRENGTH CORRESPONDING WITH THE CHANGES IN TOTAL CARBON.
FIG. 6—COOLING RATE CURVE

prove exceptional to the general rule.

In an iron of given graphitic conditions, decrease in pearlite implies lowering in strength. This phenomenon is related closely to the others considered. Its effect is demonstrated most accurately in annealed irons. Under proper conditions an annealed iron shows slight change in grain size. Comparisons may be made between annealed low carbon irons and approximately pearlitic irons of higher carbon content. Such comparisons show that the decrease in pearlite (combined carbon) in itself has less effect than might be expected. For example, ferritic irons (0.00 combined carbon) and 3.2 per cent graphite of small grain size may show over 20,000 tensile strength *with brinell* 100 to 110. An iron 0.80



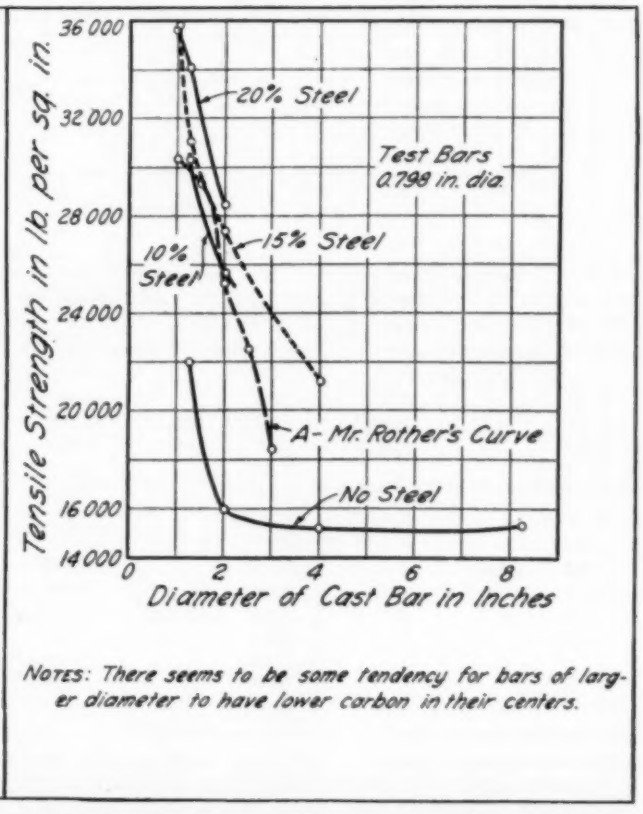

Tensile Strength in lb. per sq. in.
Diameter of Cast Bar in Inches
20% Steel
Test Bars 0.798 in. dia.
15% Steel
10% Steel
A-Mr. Rother's Curve
No Steel
Notes: There seems to be some tendency for bars of larger diameter to have lower carbon in their centers.

FIG. 7—EFFECT OF SILICON ON IRONS OF APPROXIMATELY CONSTANT CARBON. FIG. 8—RELATION OF TENSILE STRENGTH TO SECTION SIZE

combined carbon and 3.2 graphite (i. e. 4.0 per cent total carbon) of approximately the same grain size and much higher brinell will not have much greater strength. Such annealed irons show much greater strength than ordinary ferritic irons, the differences being largely in the grain size. It is common foundry experience that low combined carbon indicates a weak iron. This is because conditions promoting low combined carbon in the casting also promote formation of more graphite and increased grain size.

Changes in the strength of gray iron are made by converting the pearlite into sorbite, troostite, or martensite. The yield point of carbon steels may be doubled by suitable heat treatments. Insofar as the author is aware, similar results have not been obtained with regular gray irons. Ordinary treatments to produce machinable iron result in increase of 20 to 50 per cent in strength. This is assuming little resolution of graphite and that the iron contained no free cementite before treatment.

Grain size is a potent factor. The greatest changes effected by section size are the changes in grain size. The factor of grain size will receive further consideration in a later section on tensile strength.

The various metals and metalloids in gray iron affect the strength by (1) Stabilization of the cementite, that is, lessening graphitization. Chromium and high manganese do this. (2) Increasing the strength of the matrix. Nickel while promoting graphitization changes the pearlite to other stronger transition forms. (3) Affecting graphitization mechanically; phosphorus possibly has such an effect in some cases. (4) Influencing the formation of smaller cementite groups, hence graphite flakes through action of nuclei. No element positively shown to do this. (5) Changing the carbon concentration of the eutectic; silicon does this. (6) Promoting the formation of graphite, as silicon and carbon do. (7) Altering the pearlitic transformation range. Various alloying elements have this effect. The phenomena noted under (2) is attributed to this.

In Fig. 7 the effect of silicon on strength of irons of approximately constant carbon content is shown. Silicon exerts less influence in the more slowly cooled sections.

Tensile strength of gray iron depends on the amount and distribution of graphite; degree of graphitization; condition of the combined carbon; general grain size and freedom from shrinkage. As in the transverse test, these factors are dependent on the per cent total carbon, the cooling rate and the various elements. However, many of the effects differ in degree from those observed in transverse testing.

The effects of section size variance are greater in the tensile test. This is shown in the section tensile curves Fig. 8. The similarity in the character of results obtained by different investigators is interesting.

Presents Kinks on Face Plate Turnings

By Clarence A. Nelson

PROBABLY 75 per cent of all wood patterns are made either wholly or in part on the turning lathe. Out of this total amount it is safe to say that 50 per cent are scraped instead of being cut properly with a tool. Many patternmakers find it impossible to produce a perfect face with a tool and resort to other methods when making either small or large rings or plates. If the following method is practiced no trouble will be experienced in turning a ring or a face plate in the manner in which it should be done.

Assume that a 6-foot diameter ring is required. The circumference line is scribed on a wood face plate and the segments for the ring are built up to the desired height. The character of the available lumber will determine the best length for the segments. End grain is to be avoided. A finish allowance of ¼ or 5/16-inch is marked on the board before the segments are cut. The band saw should be held closely to the line in sawing the segments, otherwise the assembled ring will not balance, but will run out of true. Where time will permit the segments are allowed to dry further before they are used. A certain amount of moisture usually is present even in kiln dried stock.

A better job can be made with comparatively thin segments than where thick courses are employed. Stock 1¼ inches thick will be found satisfactory. After the first course is nailed to the plate it is allowed to dry for half an hour before it is faced in preparation for the next course. This is repeated for the third course and then the assembly is screwed firmly to the face plate by inserting a screw in each segment of a sufficient length to penetrate several courses. For a standard pattern or one that is to be used continually, it is advisable to drill a hole through every segment on every third course and drive long dowel pins through the entire width of the face. An exceptionally strong pattern is produced by following this method. A better chance to turn a true, even face is presented if the entire pattern is built up before any attempt is made to turn it.

The outside of the pattern is roughed off with a round nose tool. The remainder is taken care of with a diamond point or a toothed plane iron. With a view of detecting any irregularity in the face, the surface, is tested at frequent intervals with a chalked straightedge. This method of producing a finished surface is preferable to that in which a sand paper block is employed.

Tools must be sharp and held at a cutting angle. This feature may be determined from the character of the shavings. Shavings that are cut easily may be distinguished from those that merely are scraped from the surface. It is well to remember that the tool which scrapes, also is the tool which catches. It is a potential source of danger both to the operator and to other men in the vicinity.

Book Review

A Graphic Table Combining Logarithms and Anti-Logarithms by Adrien Lacroix and Charles L. Ragot, cloth, 7 x 10 inches, 50 pages, published by the Macmillan Co., New York, and furnished by THE FOUNDRY for $1.40 net.

The authors have contributed a valuable addition to the use of graphics in this new book. The logarithms and anti-logarithms are arranged similar to the scales on a slide rule and permit rapid computations. The saving in space by the use of a graphic table is remarkable. There is no need for interpolation as the number, and logarithms can be read directly without the use of a table of proportional parts. The easy manipulation of logarithms by the graphic method should tend to increase their use.

Melts Iron for Ninety Years

FIG. 1—APPARENTLY THE ONLY SMOOTH FACED BOYS BACK IN THE EARLY FIFTIES WERE THOSE WHO WERE DISQUALIFIED BY AGE FROM WEARING WHISKERS. THIS GROUP WORKED IN THE FOUNDRY, MACHINE AND BLACKSMITH SHOP OF THE ADAM'S FOUNDRY, ROME, N. Y.

WITH the proposed conversion into a boulevard of that part of the Erie canal within the city of Rome, N. Y., one of the last links connecting the Adams Foundry with the early history of the city will disappear. The canal is closed but the foundry still is doing business at the old stand. Many changes, local and national have taken place during the 90 years the foundry has been in existence, but through them all the business has been carried on by the one family through the hands of three successive generations. In the early days supplies were brought in on the canal and many of the castings and finished machines were shipped out on the clumsy old barges that were dragged slowly from lock to lock. Later the canal merely served for a water supply and now with the water drawn off, the depression in the earth is utilized as a dumping ground for the refuse from the foundry. Long before the 100th anniversary of the foundry's inception rolls around, it is expected that a boulevard at street level will follow the course of the old canal. Automobiles reflecting the brilliant sunshine from gleaming glass and nickel will glide over the smooth asphalt and eat up more miles in an hour than the plodding horses with a loaded barge in tow could cover in a day.

FIG. 2—SANFORD ADAMS, JR.

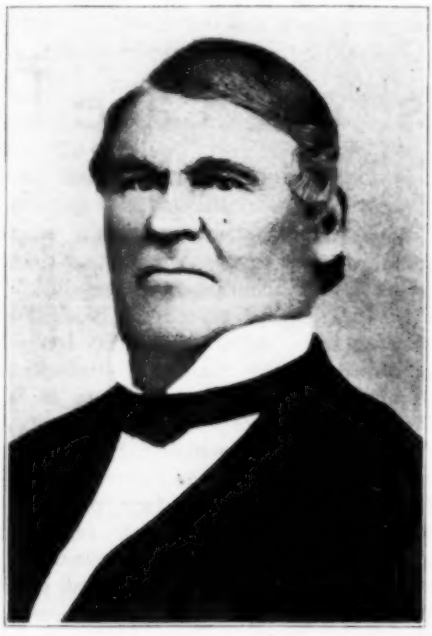


FIG. 3—SANFORD ADAMS, SR.

The history of the old foundry does not date back quite to the time when Rome was known as Fort Stanwix and regarded as the most strategically important point between the Atlantic and the Great Lakes, but it does date back to 1835 when the memory of many of the stirring events connected with the establishment of the United States as a nation were recalled vividly by men and women still in the prime of life and not merely by the oldest inhabitants.

The valley of the Mohawk had been the headquarters of the Six Nations

FIG. 4—HENRY V. ADAMS

for over 300 years and their reception of the early Christian missionaries was about as cordial as reasonably might be expected from a proud and warlike people who resented the intrusion of the white man. Afterward they lined up with the British in their attempt to destroy French supremacy in the American colonies and the tale of the atrocities laid to their account lost nothing in the telling among a generation that reckoned members among the victims.

Quietly, steadily and peacefully the little foundry has pursued the even tenor of its way in summer weather when the light waves danced and shimmered on the sparkling waters of the Mohawk and in the severe northern New York winters when the icy winds whistled down the valley and the snow drifts touched the girths of the plunging horses engaged in limited transportation.

The foundry was 10 years old at the time of the Mexican war and was going lusty and strong 16 years later when the North and South locked horns to decide whether a great nation could exist half slave and half free. Full of life and hope and the spirit of high adventure the boys from the Mohawk valley rode away from '61 to '65 with jingling bridle chains, with pennants gallantly flying and with the bands bravely playing Bonnie Eloise, the Belle of the Mohawk Vale.

Previously confined to a comparatively restricted area the music rapidly was taken up by military bands north and south and the lady from the beautiful valley in Northern New York became better known through reputation than Helen of Troy. In the heart of the camp and on the far flung outposts, by bivouac fire and while doing solitary sentry go, boys from populous cities and boys from the lonely prairie lands, sang or hummed to the best of their musical ability:

But sweeter, dearer, yes dearer far than these
Who charms where others all fail
Is blue-eyed, bonny, bonny Eloise,
The belle of the Mohawk vale.

Each man sang Eloise, but in his mind's eye he saw the girl he left behind him. When he declared feelingly that: "Dearer than all storied rivers on earth beside, is this bright rolling river to me" he saw not the Mohawk but the Mississippi, the Ohio, the Susquehanna, the Delaware or any one of the thousand and one rivers by which he played in former years.

The Adams foundry witnessed the progress of the village of Rome into a city, saw the establishment one by

FIG. 5—THE CUPOLA IS HOME MADE AND QUITE ANCIENT, BUT THE MANNER IN WHICH IT MELTS IRON LEAVES NOTHING TO BE DESIRED

one of the great copper rolling mills that justify the claim set up in large letters on one of the bridges that one-tenth of all the manufactured copper used in the United States is rolled in Rome. It weathered the panic of '73 and half a dozen others before and since that time. The particular Adams in charge at any given time took orders, made and delivered the castings, collected his bills and discounted his notes with unfailing regularity irrespective of which party sat in the high places at Washington. He attended strictly to his own business and as that eminent American, Benjamin Franklin once declared inevitably would be the case, he had a business owned solely by himself to attend.

During the long period of its existence the foundry never has closed down. It has had its lean periods when the staff has been reduced to a corporal's guard, but without exception, like the Village Blacksmith, each day has been some task begun, each evening has seen its close.

For many years the rolling mills have absorbed the greater part of the casting output, but the city also has been an important customer. Cast iron railings, garden furniture and the inevitable dog with stiffened tail and one fore foot raised that appealed to the taste of an earlier generation, still are in evidence in many parts

FIG. 6—SUBSTITUTION OF AN AUTO TRUCK FOR THE HORSE AND WAGON INDICATES THAT THE COMPANY IS KEEPING ABREAST OF THE TIMES

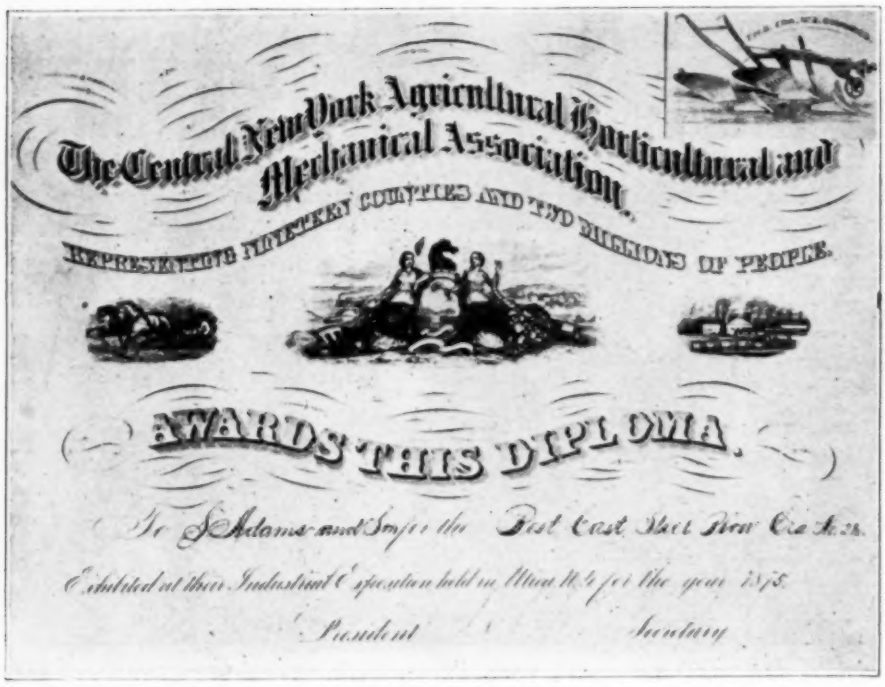

The Central New York Agricultural Horticultural and Mechanical Association.
REPRESENTING NINETEEN COUNTIES AND TWO MILLIONS OF PEOPLE.
AWARDS THIS DIPLOMA.

FIG. 7—FAC-SIMILE OF DIPLOMA AWARDED S. ADAMS & SON AT THE STATE FAIR HELD IN UTICA, N. Y., IN 1875

of the city. Columns and building hardware of various kinds were made for the stores and other buildings. The foundry furnished most of the special castings for the water works and sewerage system when they were installed, and has supplied all the castings required for repair and extension since that time.

In the early days of the industry before the mills came to Rome, the Adams foundry operated a blacksmith shop and a machine shop and engaged extensively in the manufacture of plows, shingle and lath machines, and water wheels. The plows were shipped over a wide territory and were awarded a diploma as the best cast steel plow shown at an exhibition of the Central New York Horticultural and Mechanical association held in 1875.

Shingle and lath machines were sold extensively over the United States and several were shipped to European countries and to South America. Gradually the competition of larger interests rendered their manufacture unprofitable and with the plows, they were abandoned.

A monument to the originality, initiative and mechanical ability of Sanford Adams Sr., still stands in the old machine shop in the shape of an engine lathe with a 6-foot face plate and a working length of 12 feet between centers. He designed the lathe particularly for machining water wheels and all the work from the original drawing to the assembled machine was done in his own shop.

Manual dexterity and a knowledge of the working of metals were acquired by Sanford Adams Sr., but the independent mind, the originality, the self confidence which carried him through life constituted a natural pioneering inheritance from ancestors who came over in the FORTUNE. For the benefit of any who may have forgotten the chronological order in which the early settlers arrived in America, it may be stated that the FORTUNE was the immediate follower of the MAYFLOWER.

The ancestors of Sanford Adams Sr. settled in Pomfret, Conn., and in time became landed proprietors. The name runs quite freely through the annals both ancient and modern of New England. All the family did not remain in this territory. The urge that brought them thus far impelled certain members to try other lands farther to the west. At Litchfield in the valley of the Mohawk one Williard Adams settled in the belief that no fairer spot existed and here Sanford Adams, the future founder of the Adams Foundry in Rome was born Nov. 7, 1806.

As the boy grew up he helped his father on a small furnace which he operated in addition to a farm. Natural restlessness of youth carried him first to Utica where he was employed by Hart & Pond and then to Carthage where he worked in a foundry for a few years with his brother. Later he returned to Utica and while working there in a foundry with Horatio Seymour who was part owner, he began to have visions of a foundry of his own.

Rome seemed to present the best opportunity with a small going foundry and machine shop for sale. Sanford persuaded young Seymour to throw his fortune in with him and together they embarked on a packet boat on the Erie canal and on the following day July 5, 1835 the two future business men set foot in Rome and proceeded to take over the plant. Neither one had any money, but a Mr. Johnson was so favorably impressed with their other qualifications that he supplied the capital to carry on the enterprise.

Apparently business prospered with the young men for the records indicate that 5 years later in 1840 they bought Mr. Johnson's interest. By 1850 the trade had increased to a point where the original shops no longer were equal to the demand and the first buildings of the present plant were built on the opposite side of the canal from the old buildings and facing on George street.

After 10 years of comparative peace and prosperity Horatio Seymour died in 1860. Three years later Sanford Adams became sole owner and then

FIG. 8—THE FOUNDRY AS IT APPEARED IN THE WINTER OF 1890. THE WOOD BUILDING HAS BEEN REPLACED SINCE WITH CONCRETE BLOCKS

admitted his son Sanford Jr., to partnership. Under the name of S. Adams & Son the business was continued until 1884 when full of years and at peace with the world Sanford Sr., died. His two sons Sanford Jr., and Henry V. carried on under the title S. Adam's Sons until they died, Henry V., in 1917 and Sanford in 1920. The shop now known as Adam's Foundry is owned jointly by Elizabeth W., widow of Henry Adams and the three children of Sanford Adams, William S., James H. and Mrs. Wililam H. Francis. Edith Adams Sprenger, daughter of the late Henry V. Adams is actively associated in the management of the foundry with her cousin James H. Adams.

From 10 to 12 molders are employed in the foundry and they are in keeping with the venerable character of the institution. No giddy young fly-by-night mechanics with hats cocked rakishly to one side and with cigarets drooping languidly from yellow stained fingers. Careless young cubs here today and gone tomorrow and with the result of the day's work lying lightly on their minds, the least of their worries.

The men here without exception are staid and elderly and have a proper conception of their duties and a legitimate pride in their skill as craftsmen. They do not work at break-neck speed, but their floors compare favorably with those put up elsewhere in the average jobbing shop and they require little supervision. One man has an uninterrupted record of 55 years to his credit, several have been working here for periods ranging between 40 and 50 years. The remainder are comparative new comers with periods of service from 10 to 20 years.

The cupola is patched in several places and the charging platform is innocent of a scale, but in the hands of a skillful old cupola tender the iron is melted in any desired quantity, hot enough to run needles and with physical characteristics to meet the requirements of the customers. Iron is mixed and melted by rule of thumb, but in this particular instance the thumb is the property of an exceedingly wise and canny old man who knows more about the characteristics of iron from a practical view point than many a clever young lad privileged to write chemical engineer after his name.

One of the secrets of the long continued existence of this foundry lies in the facility with which in many respects it has adapted itself to changing conditions. Recently the old wooden structure has been replaced with concrete blocks freshly painted and an auto truck has been substituted for the old horse drawn vehicles. It is the oldest established business in Rome, it has seen the rise and fall of many ambitious undertakings and now is looking forward confidently to the celebration of its 100th anniversary.

FIG. 9—JOHN WISE WITH AN UNBROKEN RECORD OF 55 YEARS SERVICE IS REGARDED AS A STEADY WORKMAN

Iron Falling on Core Causes Trouble

Question—We are having trouble with an air compressor cylinder poured on end through six pop gates ¾x½-inch. The metal strikes a small core in one end on the way down at a distance of 2½ feet from the top. We should like to have some information on how to figure the force of falling iron. Probably we should go considerably more into detail but we trust you get our meaning.

Answer—You flatter us by the assumption that we are qualified to throw light on a subject presented through meager details. If you simply want to know the rules governing falling bodies, that is an engineering proposition that can be answered satisfactorily by consulting any of the numerous engineering hand books.

However, if you are interested in devising a gating system that will insure clean castings, that is a different question altogether. If you find that a stream of falling iron cuts the core or mold at the point of contact it is apparent that it will have to be changed irrespective of whether it falls with a force of a pound or a thousand pounds. The actual force exerted has no direct bearing on the problem.

We are inclined to think that some other factor rather than top pouring is responsible for your trouble. Top pouring in itself, in a great many instances, is the logical and most satisfactory method for pouring castings. The force of the falling iron does not affect the surface of a mold or a dry sand core if proper precautions are observed. This point is exemplified every day in heavy work foundries where the iron is dropped any distance up to 20 feet.

An erroneous opinion is held by some foundrymen to the effect that the iron strikes the bottom of the mold a blow equal to the weight of a column of iron the size of the gate and extending from the runner to the bottom of the mold. A little reflection will convince any person that this is not so. In the first place the liquid iron does not strike the sand a solid blow. The instant it comes into contact with the sand it spreads and thus dissipates its energy. Further, the falling iron almost instantly forms a pool which serves as an effectual cushion for the remainder of the iron destined to fill the mold. If your bottom cores are too light or fragile to withstand the comparatively slight shock of the falling iron we should suggest that you pour a sufficient quantity of iron through a bottom gate to cover the cores and then fill the remainer of the mold through your pop gates as usual.

Discusses Crucible Care

Suggestions for the storing, handling and use of plumbago crucible are contained in a booklet recently published by the Plumbago Crucible Manufacturers' Publicity bureau, 90 West street, New York. The information contained should assist materially in reducing costs, securing steady production, and improving the morale of the employes. The booklet also indicates melting points of various metals, composition of steam and red brass alloys, tensile strength of aluminum alloys at high temperatures, and a table of sizes of crucibles.

Refractory Makers View Users' Problems

ALTHOUGH less than a year old, the American Refractories Institute which held its first technical sessions in New York, Oct. 29 proved its right to a place among the business associations by attracting more than 100 producers and users of refractory materials. The three meetings held in the morning, afternoon and evening were presided over by William C. Sproul, General Refractories Co., Philadelphia and former governor of Pennsylvania.

In introducing the purposes and plans of the institute which was organized in April 1925, J. D. Ramsey, Elk Refractories Co., St. Marys, Pa., stated that the five factors, temperature, load, abrasion, slag action and spalling must all be considered in recommending material for any specific service. Specifications place extreme requirements upon one or more of these elements, but seldom do they take all into account. He stated that the uneducated salesman, who promises the impossible in delivery and in performance is a menace to the industry. He outlined the benefits of the institute through the interchange of information between manufacturer and users of refractories.

W. A. Carter, Detroit Edison Co., Detroit and Ralph Sherman, United States bureau of mines discussed the temperature conditions which must be met in boiler operation under varying conditions of construction, fuel and firing.

S. M. Phelps, Mellon Institute, Pittsburgh, gave the results of experiments on the manufacture of refractories from diaspore, a material containing 72 per cent aluminum oxide, Al_2O_3.

In a paper presented at the afternoon session, outlining the probable trend of specifications, J. S. McDowell, Harbison-Walker Refractories Co., Pittsburgh, claimed that specifications should state the physical properties within economic limits and that service requirements should govern. Many refractories are shipped upon the users insistence although they are not capable of meeting the service requirements. He cited the dearth of knowledge of operating demands and instanced the use of cupola blocks where the temperature is practically the only known factor. Demand for special shapes to meet varied designs places a tax of more than $1,000,000 annually on the producer for molds alone.

M. C. Booze, Mellon Institute, Pittsburgh, acting secretary of the refractories organization traced the development of test and research study at the institute through the fellowship established in 1917 by the organization of refractories manufacturers and various other agencies. Control tests have been devised and more than 30 separate research studies have been instituted. This work is carried on under direction of an advisory committee made up of P. S. Kier, Kier Firebrick Co., Pittsburgh, chairman and the following members: J. S. McDowell, Harbison-Walker Refractories Co., Pittsburgh; C. C. Edmunds, McLain Firebrick Co., Pittsburgh; E. H. Van Schoick, Chicago Retort & Firebrick Co., Chicago; L. C. Hewitt, LaClede Christy Clay Products Co., St. Louis; C. E. Bales, Louisville Firebrick Co., Louisville, Ky.; W. E. Dornbach, General Refractories Co., Philadelphia; S. M. Phelps and M. C. Booze, Mellon Institute, Pittsburgh.

At the banquet held at the Waldorf-Astoria in the evening, C. M. Schwab, Bethlehem Steel Co., stated that the first basic refractory material was used under his direction in lining No. 1 open-hearth furnace at Homestead, Pa. This work was performed by an experienced Scotchman named Purvis who was brought to this country for the purpose. Today more than 90 per cent of the steel made in open hearth furnaces is produced on basic bottoms. Mr. Schwab commended the co-operative effort typified by the refractories institute. He advised free interchange of information and remarked that in the early days in the steel business, the cost books were guarded so jealously that they were locked in the safe at night through fear some clerk would return to the office and steal information. Today the phase of business having to do with return is more important than that of production, and he urged the comparison of costs and a study of the users' needs.

Elisha Lee, vice president in charge of operation, Pennsylvania railroad system, in some observations on the present day hand-to-mouth buying with meager yard stocks remarked that a plant on his line had to shut down because an incoming freight train with a shipment of new materials was three hours late. Prompt freight handling has cut down the stocks maintained, and less capital than ever before is tied up in materials on the yard and in transit. Mr. Lee stated that the railroads request full report of the coming Congress for measures that are fair and proper.

George Wharton Pepper, senior senator from Pennsylvania, in the concluding address, stated that he does not fear the hysterically advertised currents that are supposed to be undermining American religous, social and political life. He sees no cause for pessimism in the temporary and spasmodic destructive tendencies of the day. The decline of authority already has brought a swing back, typified in political results.

What Sticks Must Serve

TWO producers of refractory clays were deploring the lack of definite knowledge about daubing materials among foundrymen, at the recent meeting of the American Refractories Institute. One said, "I've seen many tests made, and many conclusions drawn, but the one that takes the prize is the regular procedure of a nigger in a big shop in Illinois. He stands beside the pan mixer where he is tempering the clay, taking an occasional handful from the mass. He compresses each sample into a ball and then tosses it to the concrete floor above. When it sticks, he stops the mixer and announces the batch is ready. And that shop won't buy a clay that fails to stick to the ceiling when wet."

W. A. MacFarland, who has represented the Abrasive Co., Philadelphia in the Detroit district for a number of years, has opened an office at 149 Larned street, E. Detroit.

The name of the Walworth Mfg. Co., Boston, has been changed to the Walworth Co.

Discuss Standard Specifications

Keen Interest Displayed in Group Meeting of American Society for Testing Materials—New Specifications To Be Submitted

AN ENTHUSIASTIC group meeting of the American Society for Testing Materials was held at Cleveland, Oct. 27-29. Fourteen committees with their numerous subcommittees held sessions during the three day meeting. These were attended by about 275 members and guests representing the various industries concerned, such as producers and users of iron and steel, nonferrous metals, gypsum, etc. Representatives of railroads, public utilities and the federal government were present.

Keen interest was displayed in the subject of the corrosion of iron and steel. This subject is of vital importance because of the vast amount of steel used in construction. The committee on corrosion has carried out some valuable tests on uncoated steel sheets and is planning now to expose a number of metallic coated products to various corrosion media, such as atmosphere, different kinds of water and other corrosive agencies.

The requirement for a yield point of 30,000 pounds per square inch for malleable castings is to be included in recommended specifications by the committee on malleable castings because engineers desire to base their designs upon the yield point values in conjunction with the ultimate tensile strength. As a result of the Cleveland meeting it was decided to use the divider method as an alternative to the drop of the beam method.

Much interest was shown in the joint research on the effect of temperature on the properties of metals. This research is sponsored jointly by the American Society of Mechanical Engineers and the American Society for Testing Materials. The need of an organized attack on this problem was attested at this meeting by reports which indicated the large number of laboratories which have worked on this problem, by the willingness of all parties to contribute information and co-operate, and by the fact that the committee has been consulted already by the users of metals who are in need of information on the subject.

A new committee to investigate materials for electric heating was organized by the executive board. The results of a study of these materials will be useful not only to industrial field, but also to domestic users since electrical heating devices are being used largely in the homes.

Considerable activity was displayed by the various sub-committees on nonferrous metals and alloys. Four new specifications for sand-cast alloys were submitted. One covers aluminum bronze, the aluminum content ranging from 7 to 11 per cent; valve bronze of two compositions, namely one bronze of 88-8-4 composition and another of the well known 85-5-5-5 and the fourth specification covering ordinary brass.

The subcommittee on white metal recommended that the tentative specifications for these materials be advanced to the status of standards. The sub-committee on light metals and alloys wishes to present with the next annual report an article on duralumin and the new light silicon-aluminum casting alloys. New specifications were presented for aluminum-base, sand casting alloys in ingot form.

Coal and coke brought forth an enthusiastic audience. Progress was reported, showing a marked activity on the part of all sub-committees. Much experimental work is under way on the improvement of methods for testing coal and coke.

Corrosion of nonferrous metals and alloys received considerable attention. The committee on this subject is conducting an extensive series of tests from which it is hoped that standard corrosion tests may be formulated.

At a dinner held on Thursday evening, J. H. Gibboney, vice president, presented some of the problems, with especial reference to membership among technical schools and colleges and the importance of these keeping in touch with the activities of the society. W. H. Fulweiler, president, discussed various questions before the executive board and announced its decision to establish the Dudley medal and the Marburg lecture.

Dr. Charles H. Howe, president, Case School of Applied Science, in an address at the dinner Wednesday evening, referred to the relationship of the technical schools and colleges to the work of the society and suggested that the society form a committee to study the educational problems that relate to the training in the technical schools. His idea was that through a study of these problems, men could be equipped for work in the field of engineering materials.

Welding Featured at Fall Meeting

OVER 2000 members and guests from all parts of the country met at Boston during the week of Oct. 19 for the fall convention of the American Welding society. An extensive exhibition held in connection with the convention was staged in the engineering laboratory of the Massachusetts Institute of Technology while the various technical sessions were conducted in the institute buildings.

Morris Holland, director of the Division of Engineering & Industrial Research of the National Research council delivered an interesting address at the banquet Thursday night in which he paid tribute to research work in all branches of industry.

In outlining the future plans of the society, Mr. Spraragen, editor of the *Journal* of the American Welding society, stated they include the expenditure of $100,000 investigating welding in connection with pressure vessels and the expenditure of a larger sum at a somewhat later date in the investigation of welding for steel structures. In addition to this a comprehensive survey of all industries in their relation to welding is to be made.

At one of the technical sessions Mr. Spraragen presented a paper on Arc Welding As a Manufacturing Process. He said the extensive and successful use of arc welding in repair work has led to the gradual adoption of the process as a means of manufacturing. One session of the convention was devoted to the strength of welds and to the quality of material used.

Robert L. Browne, Metal & Thermit Corp., New York, presented a brief

description of a welding material and the manner in which it is applied. A gap of suitable dimension is provided between the parts to be welded. This gap then is filled with molten steel at an exceedingly high temperature which fuses the adjacent surfaces of the two parts and the entire mass solidifies as a unit. He claimed the method is used extensively in the repair of heavy castings. The rapidity of the action prevents a tendency to warp and it is necessary only to allow for the shrinkage of the weld along the axis. A certain amount of blowhole trouble at one time blamed on the metal has been traced to the material sometimes used in making the mold around the weld. A highly refractory molding material with maximum porosity has been developed for the purpose which eliminates any defects of this character. The porosity aids the free venting of gases.

Clean Steel Castings Economically

BY FRED B. JACOBS

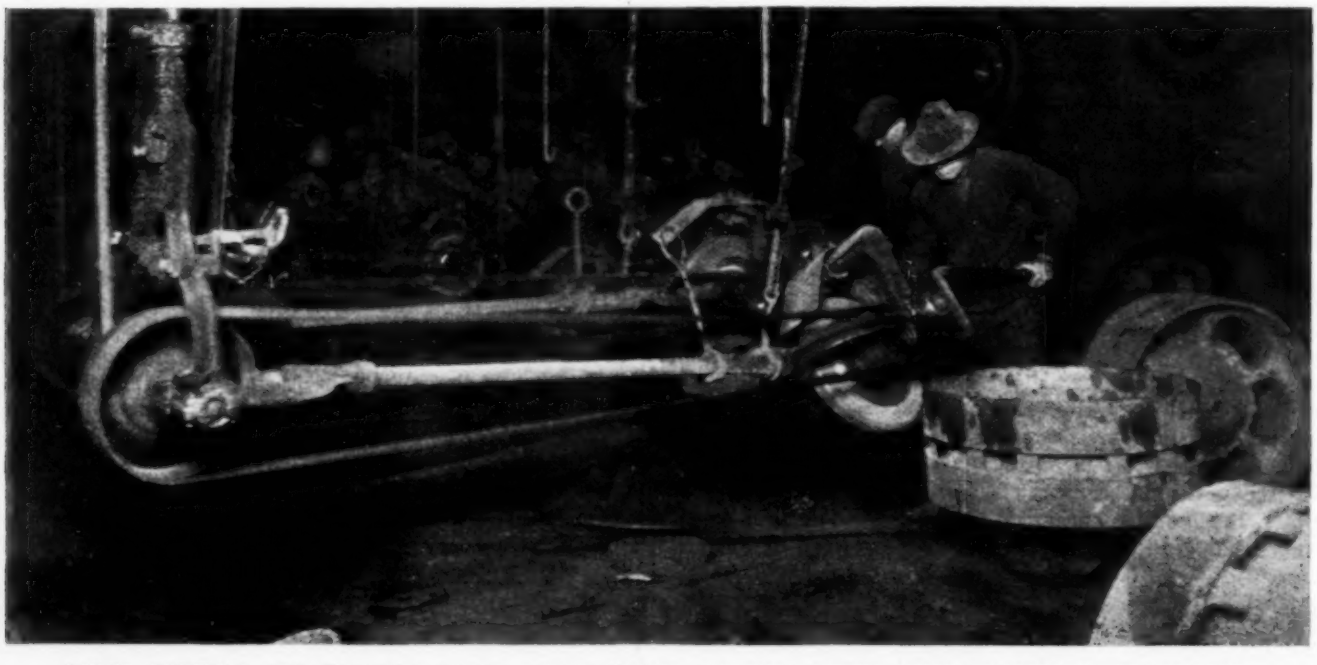
IN THE production of steel castings, it is important to give attention to cleaning costs. Steel castings are hard to clean as the high temperature at which the steel is poured fuses a certain amount of sand on the metal surface. Again steel castings must have heavy gates and risers, the removal of which comes under cleaning costs. At the plant of the West Steel Castings Co., Cleveland, about 30 tons of castings are produced daily. One-half of this output represents steel wheels for large motor trucks. Such castings must be produced carefully and they must be cleaned of all irregularities before being taken to the machining department where the holes are bored to fit the drive axles and the peripheries turned to accommodate the rubber treads. In passing, it is well to state that the cast steel wheel has solved one of the most serious problems that confronted the truck manufacturer some ten years ago.

After the castings are shaken out of the sand, the gates and risers are removed with oxyacetylene torches. Large castings then are sandblasted in a cabinet outfit, while smaller ones under go this treatment in sandblast barrels. Sand is the abrasive used in the cabinet, while steel grit is employed in the barrels. Then the castings are chipped to remove superfluous material and annealed thoroughly. Next follows another sandblasting operation although many castings, particularly those for steel wheels, are rattled with stars. The final operation is grinding followed by inspection of the castings.

The grinding equipment of the West company is thoroughly up to date. It consists of a battery of four swing grinders for handling large castings and as many floor grinders for the smaller work. Some of these grinders use wheel stubs taken from other machines. Thus after the wheels have been used to a certain diameter at a certain speed they are transferred to other grinders operating at higher speed. In this manner the peripheral speed is maintained fairly constant without altering the speed of a given machine.

The accompanying illustration shows how large castings are handled under swing-frame machines. In this instance the work consists of heavy steel truck wheels. These machines are fitted with manufactured alumina wheels 20 inches in diameter, 2½-inch face, safety flange shape. They are operated at a peripheral travel of 5500 feet per minute. Floor grinders are fitted with wheels 20 inches in diameter 2½-inch face. They are operated at a peripheral speed of 5500 feet per minute. These grinders are belt-driven. Wheels on the swing grinders last approximately 100 hours while those on the floor machines 60 hours.

While the life of the wheel is important to consider, it is not the only factor of importance entering into the question. A wheel might be made hard and durable so that it would prove long lived. However, such a wheel would not cut fast so that in using it the labor cost would be excessive for cleaning a certain tonnage of castings. The ideal wheel for steel casting work is one that cuts free and stands up to the work for a reasonable time before wearing to the point of necessitating renewal.



LARGE CASTINGS ARE FINISHED UNDER SWING FRAME GRINDERS FITTED WITH MANUFACTURED WHEELS

How and Why in Brass Founding

By Charles Vickers

Desires To Alloy Calcium with Lead

We would appreciate information in regard to the best way of mixing calcium or barium, or both with lead. In what form should the calcium or barium be used and what percentage will give the maximum hardness?

Calcium can be alloyed directly with lead by bringing the lead to a red heat and then tossing the calcium in small pieces on the surface of the lead and submerging the calcium with small phosphorizer held on a long handle. The latter will melt and alloy with the lead and in so doing will raise the temperature of the bath. There is no danger or particular difficulty in alloying these metals. An alloy of lead 80 per cent, calcium 20 per cent is very hard, brassy when filed, but short. An alloy of lead 65 per cent, calcium 35 per cent is black, brittle and of no value other than as a reducing agent. We believe that an alloy of lead 90 per cent, calcium 10 per cent will be hard enough for bearings. It is permanent in water and air and is not brittle. Lead alloy for antifriction purposes contains less calcium than the above. One analysis gave: Barium 0.8 per cent, calcium 0.1 per cent, magnesium 0.2 per cent, and the remainder lead. Such alloys are patented and it would be well to look into this situation before making the alloys. Calcium can be purchased and costs between $2.50 and $3.00 a pound.

Barium has not been prepared on a commercial scale, to the writer's knowledge, and therefore this element is not available for the purposes of alloying. It can be bought as a curiosity but the price is comparable to that of platinum, or was within recent times. To make alloys of lead and barium or tin and barium the best procedure is to electrolyze salts of barium on the molten lead. It will be necessary to experiment to discover the best kind of salts and the proper mixture.

Barium hardens both tin and lead, but there is some doubt in the mind of the writer whether barium is as soluble in these metals as calcium, also whether barium will alloy with copper. An alloy of barium and tin by one analysis, contained 10 per cent barium, and analyzed by another chemist, contained only 2 per cent. The alloy is hard, files something like bronze, and is permanent in the air. All alloys of calcium and barium high in the alkaline earth metals lose heavily when remelted, as these active elements oxidize and nitridize.

Recommends Alloy for Diecasting Work

We are manufacturing a patent ink stand and propose to make some of the castings by the diecasting method. We would like to obtain the formula for a suitable alloy. Also we would like to learn which is the better metal for the molds, cast iron or brass.

A suitable alloy for diecasting is the following:

DIECASTING ALLOY

	Per cent
Pure Zinc	92
Aluminum	5
Copper	3

This is a diecasting alloy much used. However, it is doubtful if it can be cast in brass molds. We are assuming that by the term *brass* a good grade of bronze is meant, such an alloy as copper 85 per cent; tin 14.90 per cent; aluminum 0.10 per cent which, of course is really a bronze.

For castings to be made in bronze dies or permanent mold process we suggest a good grade of babbitt metal, or the following alloy:

BABBITT METAL MIXTURE

	Per cent
Tin	61.50
Copper	3.00
Antimony	10.50
Lead	25.00

In regard to the better metal, brass (bronze) or cast iron, no decision can be given until all the facts of the case are known. The tone of the inquiry leads us to believe that diecasting is not intended but simply permanent mold casting; that is a metal mold made similar to a sand mold and filled by means of a sprue, and worked in the old fashioned manner, with clamps, instead of being operated by a diecasting machine.

Inserts Cause Blow Holes in Aluminum Castings

We are making aluminum castings that are causing us a great deal of trouble. They are in the form of a spider with a hub elliptical in shape in which is set a steel insert, and one small vertical core. The steel inserts seem to cause the aluminum to blow, always in the same place. We have tried painting the insert with linseed oil and plumbago, and we have also tried heating it. These castings are made in large quantities elsewhere and appear to be made without trouble.

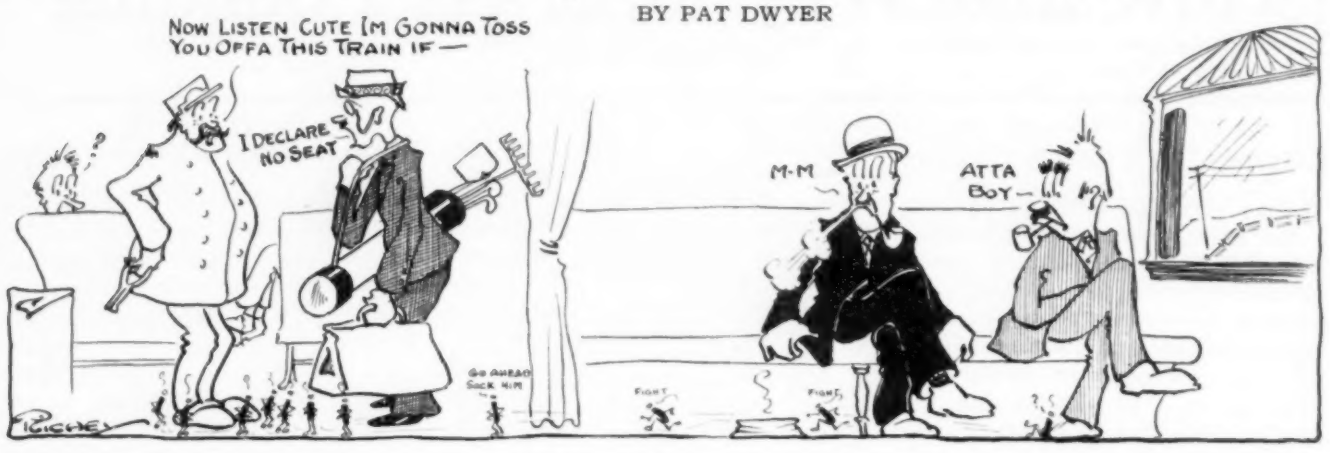
Moisture and oxides on an insert will cause a metal to blow. When the insert is heated, provided it is made hotter than 212 degrees Fahr., the moisture will be driven off as steam into the mold. It always is advisable to heat considerably above the boiling point of water, merely warming the part will not insure against blowing of the molten metal. When aluminum is run around a metal insert there is another reason for heating it and that is to expand it in order that when cooling the insert will contract and ease the strain on the contracting aluminum alloy as much as possible.

However, if the insert is steel or iron and is coated with oxide it will blow, heated or not heated. To insure against such mishaps, the part should be cleaned by sandblasting. Now it will be evident that if such inserts cleaned and bared by sandblasting are set in green sand molds and the latter are then closed and have to stand on the floor several hours before getting metal, that the moist atmosphere of the mold will rust the cleaned insert. If the insert is hot and also clean, there is no reason why it should cause the metal to blow.

The thing to do in a case such as this is to set the inserts cold after cleaning them thoroughly, and in making the mold use a facing on that part of the mold bordering the insert, that will not crumble to dust when heated. Leave the molds open, and a few minutes before pouring off time, use a torch on the inserts and get them hot, a proceeding that will not require much time, and can be done by a laborer. Close the molds, weight and pour in one operation.

Bill Claims Analysis Does Not Tell All

BY PAT DWYER



COMING home on the train from Syracuse after the recent convention Bill and I had an interesting seance with a citizen who boarded the train at Buffalo and came into the smoking compartment of the car where we were enjoying a quiet draft of the weed. Up to that time I always had regarded Bill as fairly proficient as a general all around conversationalist either as a soloist or one of the chorus, but he did not have a look in on this occasion. With the exception of answering a question now and again, this lad we met on the train entertained us with a steady flow of personal reminiscences of incidents that were spread practically over the world in a period of nearly 40 years.

The large, powerful frame and thick strong hands lent credence to his tales of a stormy life under primitive conditions in the far parts of the earth. The weather beaten, slightly pock-marked, square face dominated by an aggressive nose and a pair of bold black eyes were the outward manifestation of the wanderlust which keeps men on the move, which enables them to adapt themselves to every variety of condition and to rely on their own initiative and resourcefulness in meeting emergencies as they arise. The spirit which impels men to join forlorn hopes, to investigate God forsaken and utterly useless parts of the earth, to take part in land and gold rushes, to plunge joyfully into insurrections and revolutions among strange people without the slightest knowledge of the point at issue and without the least desire to familiarize themselves with such a trifling detail. His voice was in keeping with his physical attributes, a man's voice, deep and strong with an organ touch to some of the lower notes that lent an added attraction to some of his stories, paticularly those dealing with Mexican senoritas, boisterous nights in gambling and dance halls in the southwest and along the west coast from lower California to Dawson City. In imagination I easily could see him trolling forth *The Cowboy's Lament* in company with a band of hardy companions lounging around a camp fire in the cattle country, or in lustily singing *Blow the Man Down* while tailing aft on one of the main braces of the old windjammer that carried him to Australia.

He knew San Francisco when there was not a lock or key on Market street, when the smallest coin was two bits and every man was appraised by the look in his eye and not by the clothes on his back. The man in broadcloth took his whiskey straight alongside the hairy individual who had not shaved for six months and whose ragged clothes were held together by patches of burlap, gunny sack or flour bags. The woolly stranger as like as not held title to a mining claim rich enough to pay the public debt of the city. He carried sufficient free gold on his person to pack a burro, a pair of long 0.45's to discourage any thought of annexation on the part of chance acquaintances, a ready and accurate eye accustomed to split seconds and a pair of ambidexterous hands to manipulate the triggers with the speed and deadly effect of a striking rattlesnake.

Turbulent mining camps and one time populous towns over which the grass has been growing for years, once more assumed life and motion under the spell of the talkative stranger. Sixteen-mule, pack trains fetlock deep in the dust of Virginia City freighted ore from the Consolidadated to the smelters in Carson City. Husky sweating miners working like fiends earned from $10 to $12 a day at a time when the prevailing wages elsewhere for common labor was only $1. The famous mine is credited with having yielded silver to the value of over $300,000,000 before the mother lode was exhausted and the workings abandoned. Wealth of the owners was invested in various projects in America and foreign countries, but the wages of the miners were spent in painting Virginia City, Nev., a brilliant vermilion 24 hours a day.

The lad smiled reminiscently over reference to the White Elephant in Denver with its slogan "$100,000 always in the house. It's your's if you win it." He had seen $20 gold pieces stacked on the bar that high and that wide and that deep, indicating with his hands a space approximately 20 x 12 x 10 inches. The pile excited no more comment than a stack of pig iron or a bundle of kindling wood. Our hero modestly admitted that on sundry and divers occasions, in fact whenever he had the

A QUIET EVENING BY THE FIRESIDE

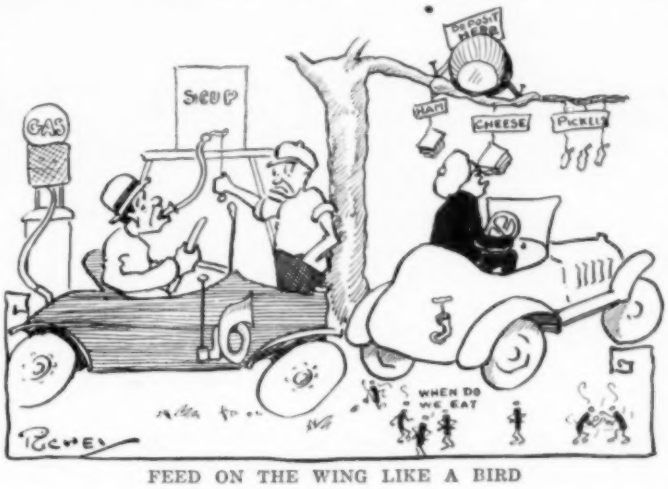
price, he had accepted the cordial invitation of the house to come and take it. Each time he left the place stripped to the bones, but the pile of shining gold still was intact.

To set this story down properly I suppose I should have commenced at the beginning. Most stories have a beginning even though some apparently have no end. In all fairness it must be admitted that in many cases that is a detail of little or no consequence. I have read stories many times and thrown them away before coming anywhere in sight of the problematical end. Perhaps you will do the same with this. In the event that your patience and good nature are not exhausted let us return to Buffalo where the story teller boarded the train.

He sat down quietly and unobtrusively in one corner and lighted his pipe. Probably, although on this point I may be mistaken, he would not have started talking if a large pompous individual outside in the corridor had not engaged the conductor in a wordy passage over a seat. This lad had failed to secure a reservation before boarding the train and was amazed and indignant to find that all the seats had been taken. Apparently he labored under the impression that the Pullman company ran cars just for fun or possibly for exercise and that a large assortment of seats always was available from which to make a selection when business or pleasure urged him to take a jaunt over the line. Speaking offhand and without holding any brief or excess love for the Pullman company I have no hesitation in stating that it's policy is not along that line. In my own experience almost invariably I find when I apply for a reservation several days in advance of a proposed journey that the cars are like the old woman who consulted the dentist, all the lowers are gone and only a few uppers are left.

"This certainly is a luxury loving age" said our friend with a nod and a grin toward the corridor. "I wonder what that bird would have done if he had to travel with some of the rigs I was forced to use in places that never saw a train until many years after I had passed that way. For that matter I have been in places where trains are unknown to this day and where in all probability they never will penetrate.

"Many a weary mile have I covered on mule back, on horseback and weariest of all on my own feet. I have ridden blind baggages, and been kicked off the rods, the roof and the inside of practically every variety of freight car in existence. If that lad had climbed into Alaska over the Chilcoot pass with the snow up to his oxters or if he had to mush behind a dog team for miles in the face of a driving blizzard he would be willing to get down on his hands and knees and offer thanks for



FEED ON THE WING LIKE A BIRD

a seat on the floor of a box car instead of standing there yowling like a coyote with the toothache because he could not get a private seat with a cushion and a porter to anticipate his slightest wish. If this train is five minutes late he will bawl out the entire crew from the engineer to the rear brakeman and then write a stinging letter to the president of the road the first thing in the morning, about 10 a. m., before he hangs up his hat and cane.

"Men are getting soft and effeminate from an overdose of soft food and easy living. The only use they have for their hands is to convey food to their mouths and if they were forced to walk a mile for a camel or any other animal they would drop dead. At the rate they are going I expect the men of the third or fourth generation will be equipped with nothing but an elongated stomach and will drive up to a filling station for sustenance at regular hours five or six times a day. One shot for the gas tank and one for the driver.

"Those boys who think the world is coming to an end if they miss a meal would have a different conception of the relative importance of food if they had to carry a month's supply on their backs, or if their supplies ran out several days before they arrived at their destination. Flour and water mixed to a paste and scorched over an open fire and slabs of sow belly warmed over the flame on the end of a pointed stick might not tempt a modern epicure, but believe you me I have seen the time when I would not have exchanged them for all the gold and silver in the Sierras. The cuckoo who invented the saying about hunger being the best sauce said a mouthfull.

"In these finicky days a man won't take a hotel room unless it is equipped with a bath, a clothes closet, a reading light and a window facing south. A telephone is considered a necessity and the traveler counts that day lost when he has not had at least one interview with the valet, the proprietor of the beauty parlor and the bell hop who says 'Yes sir, I can get you a bottle.' The lad wants at least three towels each time he washes his face and hands and spends more time in selecting food from the menu card than Grant devoted to the preparation of plans for the siege of Richmond. Talk about your southern hospitality. I slept in a hotel in Nashville one time where I was welcomed by thousands of visitors every night. They ran all over the bed, over the floor and crept into every pocket and fold of my clothes. I trust I am no more fastidious than the average man, but I draw the line at undue familiarity. By way of a hint I secured a length of wire and suspended my clothing from the chandelier and gentlemen you may believe it or not, but these enthusiastic little insects climbed up the walls, crept out on the ceiling and then jumped down on the garments.

"In the early days of Oklahoma City I slept in a canvas hotel equipped with about 200 little cots and where the only toilet facilities were a tin basin full of water and a roller towel. About every twelfth man refilled the basin from a pump, but every man jack in the crowd used the roller towel. I don't believe it ever was changed. I am amused when I read warnings against insanitary surroundings and the danger of infection from the use of public utilities. In company with that band of Yahoos collected from all parts of the earth I used that towel for a month and never was in better condition in my life."

A question about gold mining brought forth the statement that Mexico is the greatest gold country in the world.

"You can get it down there" said he "but you'll never bring it out of the country. The Indians know where it is, but they never collect any more than is needed for their immediate requirements. I have seen an Indian

with a pouch full of free gold enter a trading store and order a supply of goods. The trader weighed out a sufficient quantity of gold to pay for the goods and handed the pouch back to the Indian. The gold digger mounted his pony and somewhere on the homeward trail beyond prying eyes he scattered the remainder of the gold on the ground. Why burden himself with useless baggage when he knew he could get a fresh supply whenever he needed it?

"These Indians are the distilled essence of the lowest form of humanity. They will welcome a stranger with every manifestation of friendship and if necessary share with him the last crust in the house. After he goes to sleep they will cut his throat, steal everything he owns, strip him clean and throw his body to the vultures; charming people, but slightly eccentric. Through the excessive if somewhat mistaken zeal of an attractive young lady I came within an ace of leaving my own bones in Durango. An innocent flirtation on my part developed into a romantic attachment on the part of the lady. When I called to say a final goodbye she threw one arm affectionately around my neck and with the other hand she drove a stilleto up to the handle between my ribs. I had told her I never would leave her and by the horny toes of old Montezuma she almost forced me to keep my word. I was three months in a hospital, and I made no more love real or assumed below the Rio Grande."

After we left the train I asked Bill if he thought our friend had been toying with the truth. "Well" said Bill "I'll tell you. I am not in a position to judge the veracity of his statements where the scenes are laid in foreign countries, but they tally closely with stories told by a famous old hobo molder known as Cigaret Jack who had worked in every continent on the globe. From my own personal experience in many of the places he mentioned in this country I am inclined to the opinion that while he may have exercised the story teller's privilege of slightly embroidering some of the incidents and probably incorporated a few of other men's adventures with his own, still in the main they are substantially correct.

"Travel has a wonderfully broadening effect on one's mind. Extensive reading has something of the same effect. Experience in one or both lines might have prevented a certain purchasing agent writing to me recently to furnish him with the correct analysis of molding sand suitable for castings ranging in weight from 200 to 1500 pounds. He did not state whether the castings were gray iron, malleable iron, aluminum, brass or steel. He did not indicate whether the sand was to be used in green sand, dry sand or loam molds. In fact he did not give a single one of the half dozen or more essential features which must be considered in the selection of molding sand. He just said he wanted the proper analysis of sand for making castings from 200 to 1500 pounds.

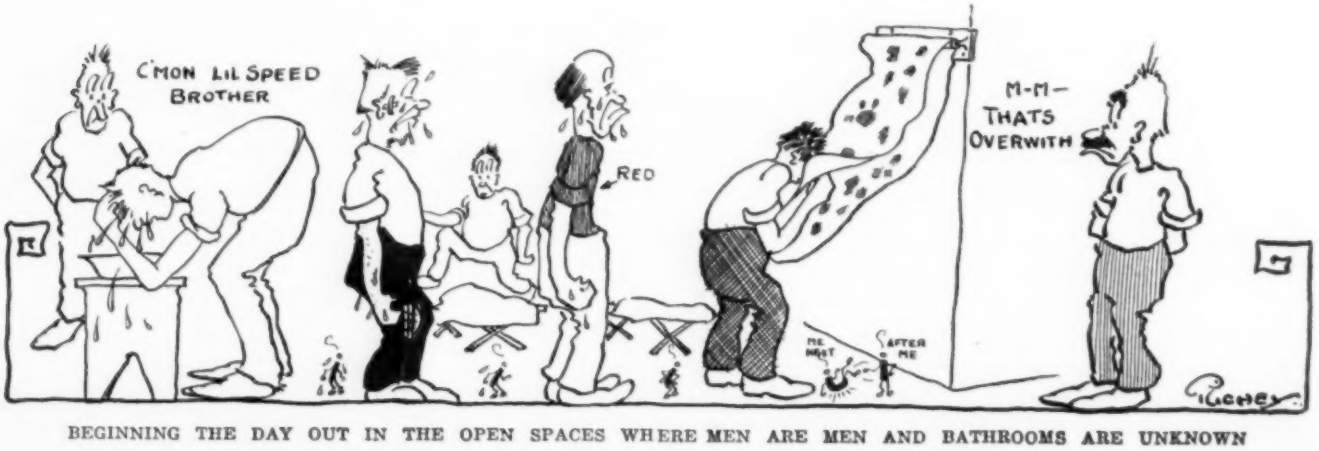
"If any person could supply a definite answer to that question he would merit the gratitude of every foundryman in the country. If it was possible to judge sand solely by analysis the troubles of the foundryman would be reduced by at least 50 per cent. If the weight of the casting furnished a criterion by which to select the sand, the problem no longer would be a problem. Any foundryman knows that a much more refractory and open sand is required for a chunky 200-pound casting than for a 1500-pound casting in which the section is thin and where the casting is spread over a large area.

"Analysis is only one of the features to be considered when ordering sand. Refractoriness, permeability, strength, amount, quality and distribution of bonding material are important features. From an endurance standpoint a relatively high first cost sand may prove more economical over a period of time, than another sand satisfactory in every respect with the single exception that it has a short life and must be renewed frequently.

"A prominent feature of all eastern sands is that they are high in silica, open and may be rammed quite hard. Western sand under similar conditions would produce nothing but scrap. As a compensating measure western sand retains its bond longer than sand found in the east.

"A great deal of research work has been done in an attempt to standardize tests by which sand may be graded in relation to the particular use to which it is to be applied, but up to the present no definite conclusions have been reached. Many individual plants have worked out standards for their own requirements and select their sand according to empirical formulas, but these standards only could be applied in other foundries where identical operating conditions prevail.

"Foundrymen who are fortunate enough to have a reliable source of supply continue to place their orders with sand supply men in whom they have confidence. Laboratory tests have been developed for judging the qualifications of molding sand, but up to the present the necessary equipment has been installed in only a few places. Experienced foundrymen trying out a new sand base their conclusions on a practical shop test in which the sand is brought into contact with the molten metal under actual foundry conditions. What a man hears may leave little impression on his mind, but what he sees with his own eyes usually has a convincing effect. That will be all for this evening. Goo'night!"



BEGINNING THE DAY OUT IN THE OPEN SPACES WHERE MEN ARE MEN AND BATHROOMS ARE UNKNOWN

Structures Change with Alloy Additions in Ladle

FOR many years the Driver-Harris Co., Harrison, N. J. has conducted a foundry where castings are made in sand molds in addition to the ingots and billets that are cast in iron molds for subsequent reduction to many shapes in other departments of the extensive plant. No less than 45 alloys are on the regular list and while the entire 45 varieties never are made on any given day, still there are days when the number of individual heats tapped reaches a high total. Metal is melted in two, 3-ton, heroult, electric furnaces and in one smaller furnace of the same make. Small heats are melted in a battery of oil fired crucible furnaces. Castings range in weight from little trifles of an ounce or less up to several tons. Long, running orders for certain castings are the exception rather than the rule and this accounts for the large number of individual heats required on some days. So far as is practical, the orders are classified according to the character of the alloy required, but, as in nearly every foundry, the time element sometimes interferes with the program.

Use Nickel-Chromium Alloy

Metal used in all the castings is a steel alloy containing exceptionally large amounts of nickel and chromium and is designed primarily to resist heat and corrosion. It finds application in annealing boxes, containers employed in heat treating, retorts, spiral drums in which steel balls are hardened, thermo-couple tubes; besides baskets, vats, tanks pipe connections and the almost endless variety of castings large and small employed in the manufacture of chemicals. The claim is not made that the metal is indestructible or that castings made from it will last forever. In nearly all cases the castings are subjected to the most severe service where frequent replacement is recognized as a necessity. The period of service varies according to local conditions, but it is claimed that records of endurance twelve times that of ordinary cast iron or plain carbon steel are not unusual.

Practically the same molding and melting practice are observed in handling this metal as are found in regular steel foundries where plain carbon steel exclusively or almost exclusively is melted and poured into the molds. Some of the smaller castings are poured in green sand molds, but the greater number of the molds are dried. Silica sand either new or mixed with old sand, depending on the section of metal to which it is to be exposed, is used for the molds and cores. Large sink heads are placed on the castings and the ingot molds are provided with *hot tops* after they are poured. These additional bodies of hot metal compensate for the shrinkage and prevent shrink holes and piping.

Add Alloy To Cast Iron

Success which followed the introduction of this special metal led the management to speculate on the probable result if a limited quantity was added to cast iron. Independent experiments carried on by many foundrymen and others have established the fact that cast iron is benefited in many ways from the addition of limited amounts of nickel and chromium. One prominent pig iron producer has based its selling campaign for many years on the fact that its foundry iron is made from an ore which carries an appreciable content of both nickel and chromium. Many articles published in the technical press have dealt with the subject, particularly of nickel additions to iron used in foundries devoted to the production of castings for the automotive industry.

With such an array of precedent, the Driver-Harris Co., in the person of its foundry superintendent had no hesitation in trying a series of experiments to determine, first if the addition of the material conferred any real benefit on cast iron and, second, to devise a method by which the addition might be made with a minimum amount of trouble and in such a manner that the amount of each element added might be controlled accurately.

Evidence secured from a number of tests indicated that the quality of the iron was improved to a material extent. Both tensile and transverse strength were increased and the character of the iron was changed in relation to its machinability. Although it was much harder according to a brinell reading, still it offered no more resistance to the tool than, and cut just as freely as iron that had not been treated with the alloy. The explanation offered for this is that the addition of nickel and chromium do not affect the carbon in the iron from a chemical standpoint, but they do affect the physical structure to the extent that the carbon is redistributed throughout the mass in a changed form.

In ordinary foundry terms the grain of the iron is closed, but not by throwing an increased amount of carbon into the combined form with the iron, a move which inevitably increases the hardness of the product and its resistance to tooling of any kind. Illuminating evidence of the change in physical structure is shown in specimens that have been cut from test bars and then ground and polished to a mirror-like surface.

Foundrymen generally are familiar with the fact that the addition of steel to the cupola charge affects the product in a similar manner, but so many variables are present that the addition of steel is a hazardous process except under the direction of a skilled melter.

Alloys Easily In Ladle

Familiarity with the foregoing features and confidence in the efficacy of the alloy as the result of numerous tests led the originator to speculate on the most convenient method by which it might be introduced into the molten iron. Steel melting experience suggested the idea of adding it directly to the metal in the ladle after the manner in which aluminum is added to *kill* a wild heat of steel. The facility with which the end of a skimmer may be melted off in a ladle of hot metal seemed to indicate that no particular trouble would be experienced in adding it in that manner. After three or four trials the method at present in use finally was adopted and according to report has proved eminently satisfactory.

The alloy on which patents are pending is made up of nickel 60 per cent, chromium 12 per cent and the remainder low carbon steel, melted in an electric furnace and poured into castings the same shape and size as small aluminum ingots, approximately 15 inches in length, 2 inches wide across the top and nicked for break-

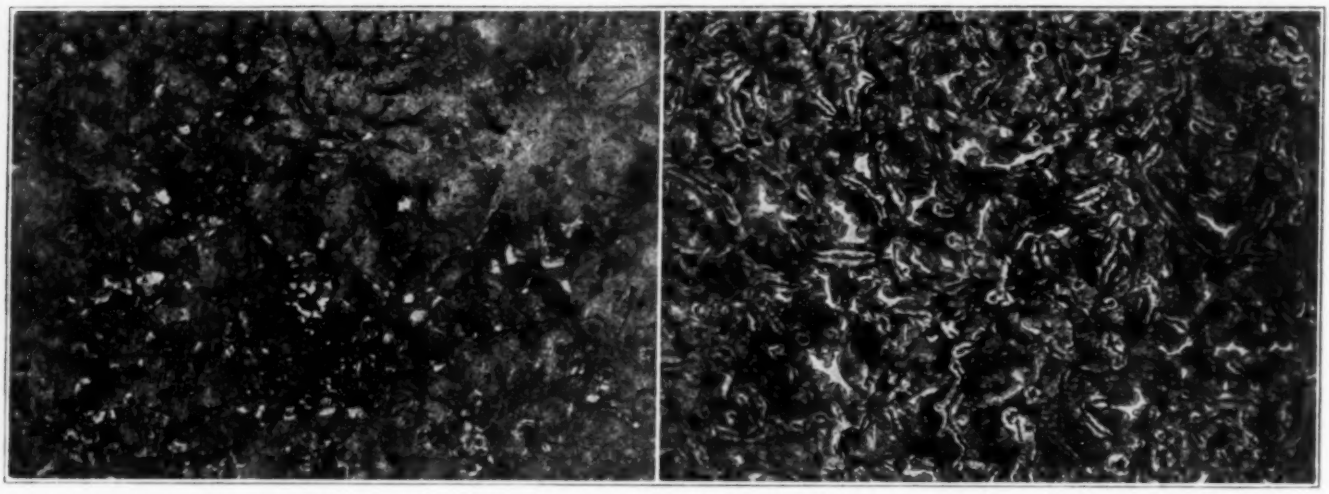


FIG. 1—UNTREATED IRON MAGNIFIED 100 DIAMETERS. FIG. 2—THE SAME IRON WITH AN ADDITION OF 2.00 PER CENT OF THE ALLOY SHOWN AT THE SAME MAGNIFICATION

ing into five sections. In the alloy each section is designed to weigh 1 pound, and this together with the knowledge that the alloy contains a definite amount of nickel and chromium reduces what little calculation is required, to a minimum.

Several automobile engine casting foundries are using the alloy regularly in their practice and report that several features in their castings have been improved to a material extent. Obviously, the exact amount used is not the same in all places and while no direct figures actually are available it may be said that the amount of the alloy used varies from 1.00 to 3.00 per cent.

In practice, the necessary amount which naturally is not large, is placed on the bottom of the ladle and subjected to the action of the stream of iron until the ladle is filled. Usually it is completely dissolved by that time, but if not the small remaining portion easily is stirred with a rod until it disappears. Under ideal melting conditions iron is tapped from the cupola at a temperature between 1400 and 1500 degrees Cent. which is approximately the same as the melting point of chromium, given as 1520 degrees, iron or low carbon steel 1530 degrees and nickel 1453 degrees. The makers state that this material acts in the same manner as many other alloys which melt at a lower temperature than any one of their component parts.

The difference between treated and untreated samples of iron is shown in the accompanying reproduction of four micrographs made from test bars poured from three succeeding ladles of iron taken from the one tap. The samples shown in Figs. 2 and 4 were treated with 2.00 per cent of the alloy and the magnification is 100 and 200 diameters respectively. The remaining two tests were taken from untreated iron and also are shown in Figs. 1 and 3 magnified 100 and 200 diameters respectively.

An analysis of the treated iron showed:

	Per cent
Carbon	3.14
Manganese	0.55
Silicon	2.07
Chromium	0.42
Nickel	1.57

Analysis of the untreated iron is not available, but from the foregoing analysis it is apparent that it must have carried small amounts of these elements.

Brinell readings taken at the same time show how the hardness feature is increased by the adidtion of the alloy. The brinell reading on untreated iron was 207 to 217. With the addition of 1.00 per cent these figures were raised to read 212 to 228. Iron treated with 2.00 per cent of the alloy showed a brinell reading 223 to 235 and with 3.00 per cent this was increased to read 241 to 255.

H. P. Mackinnon now is associated with the Great Lakes Foundry Sand Co., Detroit, in a sales and engineering capacity. He has been identified with the foundry industry for 20 years, for the last eight being a sales engineer with the Wm. H. Nicholls Molding Machine Co., Brooklyn, N. Y.

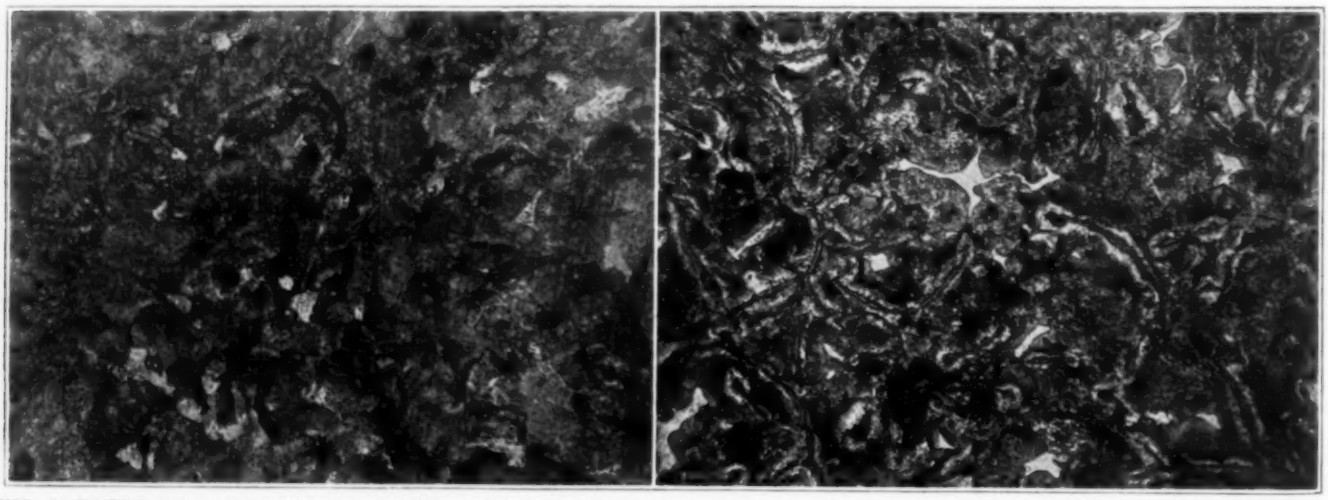


FIG. 3—UNTREATED GRAY IRON MAGNIFIED 200 DIAMETERS. FIG. 4—SAMPLE OF THE SAME IRON MAGNIFIED 200 DIAMETERS AND WITH AN ADDITION OF 2.00 PER CENT OF THE ALLOY

STANDARD HOSE CONNECTIONS FOR WELDING AND CUTTING EQUIPMENT*

Welding and cutting equipment is in use in almost every manufacturing plant, railroad shop and ship yard, and on construction, erection and demolition jobs all over the country. In fact, gas welding and cutting equipment is used universally. There are in all 25 or 30 or more different makes of torches, regulators, etc., which in the past have been equipped with various diameters and threads for hose connections. Lack of uniformity in the design and size of these fittings has caused users of equipment considerable trouble in providing adaptors and making connection between different makes of torches, regulators, etc.

To eliminate this inconvenience in connecting up one make of torch with a different make of regulator or vice versa, the manufacturers of welding and cutting equipment have established a standard for hose connection, nuts and nipples for both torches and regulators, which will soon become effective. After an exhaustive discussion of the subject by the Gas Products' association, the International Acetylene association, and engineers and other representatives of apparatus manufacturers, a standard thread and a standard design of nut and nipple have been developed and adopted.

The two associations previously mentioned have been co-operating to obtain the acceptance of this standard and up to the present time the following apparatus manufacturers have accepted the standard and agreed to make it effective beginning Jan. 1, 1926: Air Reduction Sales Co., New York; Bastian-Blessing Co., Chicago; Burdett Mfg. Co., Chicago; Harris-Calorific Co., Cleveland; Imperial Brass Co., Chicago; Alexander Milburn Co., Baltimore; Modern Engineering Co., St. Louis; Oxweld Acetylene Co., Newark, N. J.; Purox Co., Denver; Smith's Inventions, Inc., Minneapolis; Torchweld Equipment Co., Chicago, and United States Welding Co., Minneapolis. These companies combined produce the greater portion of welding and cutting apparatus and equipment manufactured in this country. Negotiations are being carried on with other equipment manufacturers with a view to making the acceptance of this standard as nearly universal as possible.

The standard has already been approved by the Gas Products' association, Chicago, the International Acetylene association, New York, and the Underwriters' Laboratories, Chicago. It is under consideration, but has not yet been formally approved by the American Welding society, bureau of standards, Compressed Gas Manufacturers' association, National Safety council, and the United States navy. It is anticipated that favorable action will be taken by these bodies in the near future and that the standard will be universally recommended and adopted in the United States.

*Developed by the standardization committee of the Gas Products association and approved by the International Acetylene association and the Underwriters' Laboratories, Inc. Adopted by leading manufacturers.

(Continued on Data Sheet No. 598)

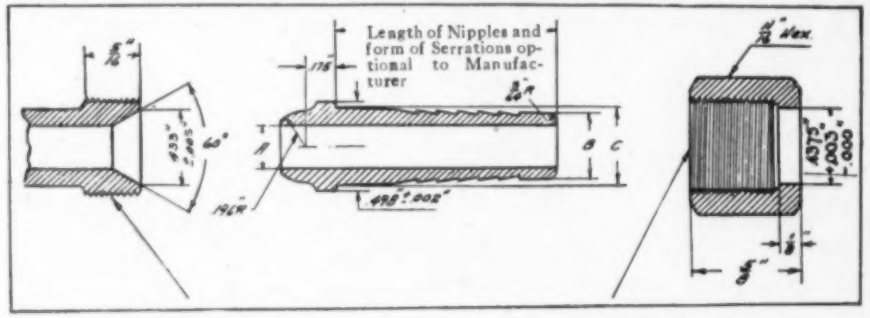
Note—This sheet may be cut into two sections, 5 x 7 inches, and may be readily bound in note book form.

STANDARD HOSE CONNECTIONS FOR WELDING AND CUTTING EQUIPMENT

(Continued from Data Sheet No. 597)

In establishing this standard design for hose, nuts and nipples careful consideration was given by the committees appointed for this purpose to adopting a design of nut and nipple and size of thread which would produce a convenient hose connection sufficiently large to permit a plentiful supply of gas to pass through the nipple and yet avoid a clumsy connection or one heavier than necessary.

A second consideration was the elimination, as far as practicable of the possibility of placing an oxygen hose upon a fuel gas nipple, or vice versa, and for this reason right hand threads were adopted for oxygen and left hand threads for fuel gas.



Thread $\frac{9}{16}$"—18 Threads per Inch

S. A. E. (P. D. = .526" $\frac{+ .000"}{- .002"}$)

American Engineering Standard B-1-a 1924 Fine Thread Series—Class 3

Tap $\frac{9}{16}$"—18 Threads per Inch

S. A. E. (P. D = .526" $\frac{+ .003"}{- .000"}$)

American Engineering Standard B-1-a 1924 Fine Thread Series—Class 3

Fig. 1. Standard Design of "B" Size Hose Connection for Large Size Torches and for Regulators using R. H. thread for Oxygen and L. H. thread for Fuel Gas.

It also was recommended that the oxygen and fuel gas nuts be marked with distinguishing letters and that the fuel gas nut be made with a groove of some sort around the hex to make it clearly distinguishable from the oxygen nut to operators, who could not read English letters.

A third consideration was the avoidance of exposed conical or rounded seats which might be damaged if struck.

(Continued on Data Sheet No. 599)

THE FOUNDRY DATA SHEET, NOV. 15, 1925

Payment will be made for all contributions on foundry and pattern shop practice suitable for publication

Around the World with The Foundry

Little Journeys to the homes of our readers

Hawaiian Islands.

POPULAR fancy pictures Hawaii as a cute little island located somewhere in the South Seas, peopled principally by a race of beautiful brown maidens scantily attired who alternate their waking hours between daring exhibitions of surf riding and playing some soulful and catchy melody on a ukelele under the witching spell of a tropical moon. A coral beach, pure and white as Arctic snow encircles the translucent sapphire waters of a lagoon in which the feathery fronds of the palms and cocoanut trees are reflected with photographic intensity.

As a matter of fact there is about as much romance connected with living conditions in the group of eight islands comprising the Territory of Hawaii as there is in Hartford, Connecticut or Hannibal, Missouri. The reciprocity treaty concluded with the United States in 1876 led to an enormous development of the sugar export trade and also stimulated the production of molasses, rice, wool, tallow and bananas.

Formerly the great bulk of the machinery required in the sugar and other manufacturing industries was imported, but at present six large and well equipped establishments comprising foundry, machine and structural shops not only take care of the needs of the territory but do a considerable amount of exporting to Australia and the Far East. Eight copies of THE FOUNDRY, the world's greatest trade paper in the casting field, are received and read twice a month by the chief executives and heads of departments in these plants.

"Wherever metals are cast you'll find THE FOUNDRY"

Traces Relation of Ferrous Metals-II—*By J. E. Fletcher*

IN THE three types of pneumatic furnaces used in the iron and steel industry the slags play an important part in controlling not only the composition of the metal by means of thermo-chemical reactions between the constituents of the metal and the slags but by their physical condition as mobile fluids act as absorbers of certain undesirable migratory constituents such as sulphides and gases and, by virtue of their heat conductivity or resistivity may aid or resist heat flow from the fuel or heating gases to the metal in contact.

If the slag composition corresponds to a condition of chemical neutrality, the basic and acid oxygen contents being equal, when functioning at suitably controlled temperatures certain objectionable reactions at the metal surface may be stopped. Thus, in the blast furnace, when the slag becomes neutral the further absorption of silicon from the silica in the slag ceases. Until this point of neutrality is reached the slag, if functioning at a sufficiently high temperature will, if overcharged with silica, allow the reaction between the carbon in the metal and the free silica to proceed, silicon being transferred to the metal. When lime or magnesia is present in excess of the neutral condition the slag, if sufficiently fluid, will absorb sulphur from the metal. Further, such a condition prevents oxidation of iron and manganese for, if lime or magnesia is present in excess of the neutral requirements, the oxides of iron or manganese cannot be absorbed by the slag. Similar actions take place in cupola practice, lime and magnesia in excess of neutral requirements acting as sulphur absorbents at definite temperatures. In this case, the slags are too acid (high in silica) to function efficiently and the iron and manganese oxidation proceeds in the direction of neutrality.

Oxidize Iron and Manganese

Iron and manganese oxidation occurs at a level in the cupola higher than the position where the slags attain their proper working constituency and requisite fluidity and there is little or no contact of the fluid slag with the metal in the fusion zone. The coke below the fusion zone is then most in contact with the trickling slags and such desulphurization as occurs takes place in the coke and not in the metal. Hence the developments of methods for sulphur removal from the metal by means of slag contact as it flows into or from the well of the cupola.

The Bessemer Process

In the acid bessemer steel process it is worthy of note that the oxidation of the silicon, manganese and iron proceeds in the direction of the formation of a neutral slag but stops short at a composition which is similar to that of a normal cupola slag, in which the lime is displaced by iron and manganese oxides. Here, as in the cupola, the oxidation of the silicon, manganese and iron takes place in the absence of slag, the oxides formed uniting to form a slag at the metal surface. There is also considerable further oxidation of the iron and manganese which passes off as fume. From the estimation of the metal loss it would appear that a slag of neutral composition actually is formed, part of which is blown away as fume. When melting high manganese mixtures in the cupola there is often much loss in fume and the slag tends toward the neutral condition, iron and manganese oxides being present in abnormally high proportions.

The basic bessemer process furnishes an example of neutral or inert slags. During the process of the blow the basic oxygen content, in the lime, magnesia, alumina, and manganous and ferrous oxides, gradually increases from 40 per cent of the total oxygen present in the slag to 50 per cent, at which point neutrality is reached. In the basic open hearth steel process similar transition in the working slags occurs during the melting and refining period. The slags, immediately after melting of the charge, may consist of oxides containing 65 per cent of acid oxygen. During the progress of the melt the constituency changes gradually from acid to basic, the basic oxygen content of the finishing slags being about 60 per cent of the total oxygen present—the point of neutrality having been passed on the way. In the acid open hearth steel melting process the working slags, by reason of the easy availability of the silicious material in the hearth lining retain a strongly acid character. The acid oxygen content is high, from 70 to 76 per cent of the total oxygen present in the slag. These slags are interesting from the fact that the composition is often closely similar to that of cupola slags. The pasty condition of slags containing more than 55 per cent silica with 10 per cent lime is analogous to cupola slags of similar composition which function badly and often give trouble in iron foundry practice. They are useless from the desulphurizing point of view and liable to affect the fluidity of the metal by encouraging bridging or scaffolding and by preventing clean and easy tapping through accretion on the walls of the cupola well.

In the puddling process the slags are composed chiefly of ferrous manganous silicates and phosphates. At the commencement of the puddling the slags are feebly acid. As the *boiling* period is approached the basic oxygen content increases and when the metal comes to grain the slag attains the neutral condition and finally contains excess basic oxygen as a result of the addition of iron oxide, produced during the oxidation of the iron during the boiling period.

Temperature Control

Under correct temperature control the puddling process is regulated by the manipulation of the slag composition. The slags never are removed far from the neutral condition and the process is slowed down when the slag becomes acid and is hastened when the slag becomes basic. The neutral condition corresponds to a suspension of oxidation or refining during the first part of the process and to a slackening in the rate of iron crystal growth, or coming to grain, in the latter half of the process.

It may be noted that in all ferrous processes mentioned the finishing of the smelting or puddling charges must be carried out in the presence of fluid slags which may be described as consisting of a neutral matrix in which is dissolved the active constituent necessary either for the alloying of the primary metal or for the re-

moval of the last traces of an objectionable constituent. The temperature at which the slags are held of course is a vital matter. The author attempted to emphasize this fact in a paper read before the British Society of Chemical Industry in 1917 on the superheating of slags and metals during refining, smelting, and alloying operations. The necessity for a mobile fluid condition in working slags first was demonstrated clearly by H. H. Campbell in 1902 or earlier. Campbell's conclusions concerning the fluid condition and the influence of excess basic or acid constituents in the working slags of the steel processes were of fundamental importance and must be considered as the real beginning of practical and scientific research.

Table IV

Transitions of Ruling Types of Slags

Process Blast Furnace	Nature of first slags Acid	Inert or neutral constituents	Nature of Finishing Slags	Excess constituents in slags
Cupola	Acid	2 $Ca.O.SiO_2$ 2 $MgO.SiO_2$ 2 $Al_2O_3SiO_2$ 2 $CaO.SiO_2$ 2 $MgO.SiO_2$	Basic Acid	CaO and MgO SiO_2
Acid bessemer	Acid	2 $Al_2O_3SiO_2$ 2 $FeO.SiO_2$ 2 $MnO.SiO_2$	Acid	SiO_2
Basic bessemer	Acid	3 $FeO.Fe_2O_3$ 2 $FeO.SiO_2$ 2 $MnO.SiO_2$ 2 $CaO.SiO_2$ 2 $MgO.SiO_2$ 5 $CaO.P_2O_5$	Basic	CaO
Acid open hearth	Acid	3 $CaO.Fe_2O_3$ 2 $FeO.SiO_2$ 2 $MnO.SiO_2$	Acid	SiO_2
Basic open hearth	Acid	3 $FeO.Fe_2O_3$ 2 $FeO.SiO_2$ 2 $MnO.SiO_2$ 2 $CaO.SiO_2$ 5 $CaO.P_2O_5$	Basic	CaO
Puddling furnace	Acid	3 $CaO.Fe_2O_3$ or 3 $FeO.Fe_2O_3$ 2 $FeO.SiO_2$ 2 $MnO.SiO_2$ 5 $FeO.P_2O_5$	Basic	FeO
Electric furnace	Basic	3 $FeO.Fe_2O_3$ 2 $CaO.MgO.SiO_2$ 2 $MnO.FeO.SiO_2$	Basic	CaO

In Table No. IV a summary of the notes is given and in Figs. 2, 3 and 4, graphs illustrative of the ruling types of slags in the transitions from the meta-stable to the stable neutral compositions may help in emphasizing the points raised. In Fig. 3 the progress of the transition from acid to the neutral and finally basic condition of the working slags of the basic open hearth steel process is shown.

No figures have been given relative to electric furnace slags but their composition progresses from a feebly basic condition to a strongly basic one, the high temperatures available being sufficient to keep slags of high lime content in the fluid state. Such slags function well as absorbers of sulphur and phosphorus in the melting process.

The well known character of the polyhedral structure of wrought iron, dead mild steel, well annealed malleable cast iron and of silicious cast iron when slowly cooled from the molten state and completely graphitized points to the possession by the iron family at large of a common structural basis.

However masked this polyhedral micro-structure may be as a result of the thermal treatment and of the alloying, more or less permanently, with non-ferrous metals or metalloids it is generally possible to so heat treat the cast or mechanically worked iron or alloy rich in iron as to bring to light the fundamental structure associated with maximum stability.

Underlying these problems connected with metal structure it must be recognized that the outer form of an individual crystal is of secondary importance. The atomic structure as revealed by the exact detail of its space lattice and the disposition of the atoms is incomparably more important. This field of inquiry is being explored but as yet the knowledge of the internal crystal structure, in most of the technically important metals, of the same space-lattice, as modified by the presence of one or more additional metals or metalloids is far from complete. In cast iron the size of the crystal grain not only varies with the temperature of casting, the mass of which the grain forms a part, and the rate of cooling, but with the metals dissolved in the iron and with the constituents present at the borders of the crystal grains and at times other factors.

If it be accepted that in the molten condition cast iron consists of iron in which is dissolved the carbides, silicides, phosphides and sulphides of iron and manganese, then on slow cooling to the stable condition where the whole of the carbon is in the form of graphite the polyhedral iron grains will be alloyed, more or less homogeneously, with the silicides of iron and manganese, and less homogeneously near the border surfaces with the phosphides and sulphides. In arriving at this stable condition the metal will have passed through the austenitic and pearlitic phases, graphite resulting from the decomposition of the carbides of iron and manganese and finally the phosphide eutectic will have decomposed, yielding iron, graphite and iron phosphide. The size of the final iron grains conceivably is controlled by the amount of supercooling which occurs just before solidification of the molten metal commences, the rate of crystal formation being dependent on the degree of supercooling and on the viscosity of the metal during crystallization. This viscosity is not independent of the metal mass and is influenced by the presence of foreign constituents dissolved in the iron. Hence it may be concluded safely that the size of the final stable crystal grains in a slowly cooled cast iron is influenced by the silicon, manganese and phosphorus present in the molten metal. Any modification in the growth or shrinkage of the nascent crystal grains, as the metal is cooling through the critical change points associated with the passage from the gamma to the beta and alpha iron conditions, must be influenced by the presence of silicon manganese and phosphorus in the iron.

In cast iron the contents of silicon, manganese and phosphorus in the final stable grains will approximate the values determined by the chemical analysis of the cooled metal. The influence of the heat liberated during the graphitization of the primary iron carbide and of the gases liberated during solidification, some of which are entrapped within the solid metal, cannot be ignored. Both these liberations are accompanied by volume changes and have an influence on the growth of the cooling crystal grains.

In steel the lower carbon and silicon contents in ordinary straight carbon steel do not influence appreciably the grain size during slow cooling but if the cooling is exceptionally slow and the metal mass great, graphitization of the primary iron and manganese carbides occurs and the final

stable structure is polyhedral-grained, the grain sizes being similar to those produced in cast iron of similar mass when cooled at the same rate. Here the graphitization follows the grain boundaries as a result of the decomposition of the carbides while slowly cooling through the temperature range above 100 degrees Cent.

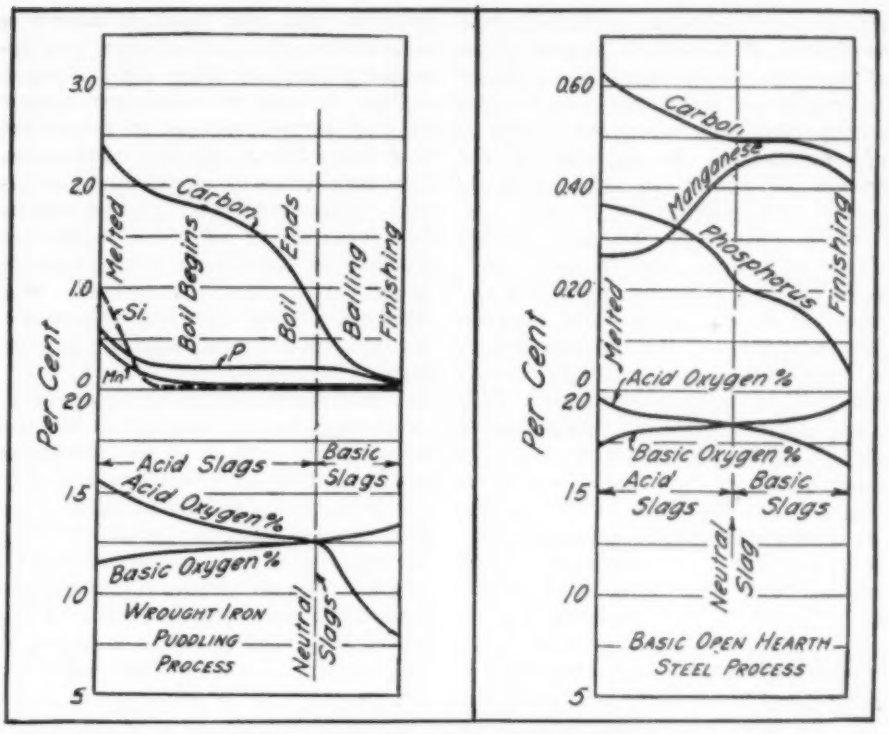
In the manufacture of puddled iron the iron grains are formed primarily during the supercooling of the alloy on the borderland between cast iron and steel, 1.8 to 2.0 per cent carbon. The grains grow rapidly and have envelopes of pure iron. The centers of the grains, or clusters of grain, are richer in carbon than the outer envelope. The squeezed plastic mass of puddled iron is composed of crystal grains of similar form and often of similar size to those associated with the structure of slowly cooled cast iron. The grain size in puddled iron is influenced by the manganese, silicon and phosphorus content of the pig iron from which the iron is made and in some cases the original carbon content of the pig iron appears to play a part.

Marked Similarity of Structures

Puddled iron therefore may be considered as being the result of slowly cooling a cast iron through the higher temperature ranges, the carbon, silicon, manganese, and phosphorus being removed by oxidation during the liquid and plastic ranges. The gradual reduction of carbon during the plastic period is equivalent to the graphitization and decarburization which take place during the malleable whiteheart process. The two final and stable structures are remarkably similar both in the form and size of the polyhedral iron grains—in the wrought iron and in the completely decarburized areas of the malleablized cast iron. The coincidence of low manganese and silicon content in similarly grained wrought iron and malleable cast iron should be noted.

In the foregoing notes, stress has been laid on the stable character of completely graphitized cast iron, steel and malleable cast iron; wrought iron being placed in the category of a slowly cooled cast iron from which the carbon is removed by oxidation mainly during the semi-solidification of the virtually cooling metal, there being no pearlitic range during the transition.

This stable condition of approximately ferritic metal calls attention logically to the fact that when cast, pig iron or steel containing combined carbon, is of unstable structure. The transition constituents austenite, troostite, martensite, sorbite and pearlite in cast iron, malleable cast iron, and steel are relatively unstable in comparison with wrought iron and dead mild steel. To insure the maximum stability of a steel containing a mixture of constituents a suitable heat treatment is necessary to homogeneously mix the constituents. In grey cast iron of normal composition the constituents never are mixed homogeneously as ordinarily cast; owing to the differential rate of cooling from the outside to the inside of the mass. Hence the attempts now being made to regularize the structure of cast iron by approaching a structure which is completely composed of pearlite and graphite.



FIGS. 2 AND 3—GRAPHS ILLUSTRATE THE RULING TYPES OF SLAGS IN THE TRANSITION FROM META-STABLE TO THE STABLE NEUTRAL COMPOSITION

A careful examination of a homogeneous pearlitic structure in cast iron shows that the pearlite occurs in polyhedral grains of similar contour and size to those which would result from slowly cooling the cast iron, after reheating to the melting point, to the point of complete graphitization. This pearlite filled grain structure is evidence of the effectiveness of the cooling rate which has produced it and of the stability of this type of pearlite. Experience has proved that confused structures in the pearlitic areas of steel or cast

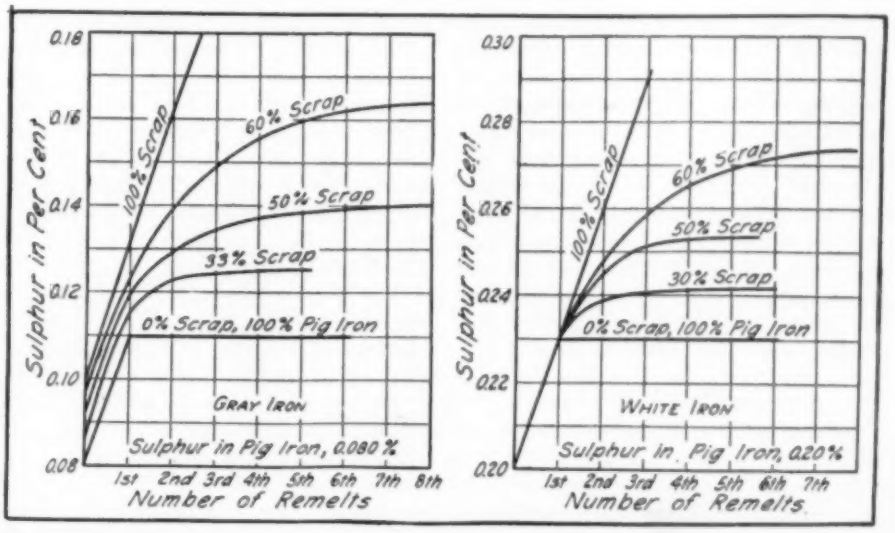


FIG. 4—SULPHUR CONTENT RISES RAPIDLY IN PROPORTION TO THE NUMBER OF TIMES THE METAL IS REMELTED AND TO THE AMOUNT OF SCRAP IN THE MIXTURE

iron are indicative of internal strained conditions, the result of unequal rates of cooling within the mass. These heterogeneous structures may be connected with the imperfect diffusion of the various ingredients of the charge as melted in the cupola or open hearth furnace.

Much remains to be done in the study of grain size in cast iron, wrought iron, malleable cast iron and steel but there is much that suggests the possibility of the original grains, as formed during the solidification of the casting or ingot, retaining their form within the metal mass, masked though their boundaries may be by later reheating and the break-up of the internal structure of the grains. This suggestion receives support from the fact that an originally coarse grained iron may be so heat treated as to break up the structure and destroy, apparently, the primary grain boundaries. Yet, after reheating to near the melting point and slow cooling the large grains reappear copies of their former selves. Perhaps they never actually lost their entity, but were masked by the thermal treatment which only broke up the crystalline structure of their interiors.

Difficulty of estimating for any country with any degree of accuracy, the percentage of scrap produced in terms of the tonnage of pig iron, iron castings, steel and iron rolled, forged, stamped and drawn material, and of steel castings and ingots, per annum, is admittedly great; but to get even a rough idea of the trend of manufacturing methods the function of scrap in ferrous processes must be visualized.

Amount of steel and iron used in structures and articles having short life through wear and tear, oxidation, corrosion, irrecoverable loss through shipwreck and accident is increasing yearly. Changes in engineering practice, causing machinery to rapidly become obsolete, particularly in the marine, railway and road traction, electrical and chemical engineering branches, are responsible for the return to the iron and steel works of scrap at a rapidly increasing rate. To this the return of war scrap must be added, together with the scrap from the demolition of out-of-date factories and plants.

Assorting Scrap

To use up the bulk of scrap available and to prevent its too rapid loss through corrosion alone, the mixtures for steel furnaces, foundry cupolas, and wrought iron scrap furnaces must contain increasing percentages of scrap. The growing use of direct metal from the blast furnace to the steel furnace throws a larger scrap proportion upon the remaining furnaces using solid charges.

One, if not the greatest factor in this scrap problem is the effect now being felt in pig iron production. The temptation to use scrap of a nature unusable in steel and iron melting furnaces, as additions to the ore charges in blast furnaces, cannot be ignored by the foundryman, who often is puzzled to know the reason for abnormal happenings in his castings.

The difficulty of assorting scrap in these days and of judging its character by appearance alone constitutes a serious danger. The fluctuations in the scrap and pig iron markets cause alternations of runs on either scrap or pig. As a consequence the quality of the cheaper grades of steel and iron fluctuates. The tendency is for good quality scrap to be scarce during certain boom periods and the poorer qualities to accumulate. Then follows a harvest of poor steel and iron products, the result of the temptation to use cheap scrap. Obviously, the scrap seller always can drop his price to cut out pig iron competition.

The greatest sufferers from these scrap fluctuations are the foundrymen and wrought iron manufacturers for, wherever these cannot supply their own scrap needs so-called *foreign* scrap has to be purchased.

Use Scrap in Blast Furnace

It is clear that if metallurgical control is necessary even when using the best of available ores and pig irons, to guarantee high quality *safety-first* iron or steel, such control is almost hopelessly impotent when from a third to a half the furnace charges must consist of scrap of doubtful character.

In the blast furnace the charging of mixed cast iron and steel scrap, iron and steel turnings, bundled detinned sheet and clipping scrap, odd materials generally unusuable elsewhere, has resulted in a mixed variety of pig iron of most uncertain quality, the scouring of the scrapyards of Europe.

The most expert metallurgist would be baffled were he to attempt a forecast of the pig iron composition and structural analysis made from burdens of this character. More especially when coke of variable sulphur and ash contest must be used.

To safeguard his product, the wrought iron manufacturer who values his reputation has had to make his own scrap from puddled material of known character.

In the steel works the growing use of high scrap proportions in the furnace charges has also had its dangers. It has been exceedingly difficult to keep metal containing unexpected alloyed materials such as nickel and chromium out of the mass of bought scrap. Batches of high sulphur and high phosphorus metal occasionally drift in mysteriously without warning.

Establish Scrap Melting Centers

The gathering of scrap ferrous material into specific areas where it can be dealt with systematically is occupying the attention of many metallurgists and some attempts are being made to accumulate cast iron scrap at convenient points where it can be remelted and disposed of as scrap pig iron. Unless a careful system of chemical analysis is employed at these scrap centers, whereby a check on the composition of the remelted products is assured, trouble for the user lies ahead.

In the interests of the iron and steel industries this matter demands serious attention. The disposal of scrap cannot be allowed to remain in the hands of distributors who are careless and often ignorant of the scientific importance of the problem.

If well handled the whole scrap problem in any country could be solved satisfactorily and the metallurgist freed from the uncertainty he so often feels when dealing with unknown scrap.

The blast furnace, as a remelter of iron and steel scrap, possibly may be one means of economically dealing with part of the problem. The cupola clearly has much scope in remelting odd casting scrap, while the open hearth furnace may be used as a remelter of heavy scrap, and the electric furnace as a desulphurizer of such metal scrap as would tend to become useless.

To each country whose interests in ferrous metallurgy are vital, the scrap problem must become one of national importance. The time has come for serious action, for a scientifically operated control in the interests of the iron and steel industry. The foundry organizations and institutions might take up the consideration of this question with great advantage to their industries. Symposiums of papers dealing with the various aspects of the scrap problem would be of great value.

Much remains to be known concerning the influence of repeated remelting of iron on the structure of the product, as compared with the remelted virgin pig iron structure. Every foundryman has his own conception of the value of certain pro-

portions of casting scrap in his mixtures and, as a consequence cupola charges vary between all pig and all scrap mixtures.

Much has been said about the so-called inherent properties of certain brands of pig iron, the use of which often is associated with good castings. In Britain all-mine pig irons are sought because they balance the evil effect of scrap metal which by repeated remelting, has passed a possible critical point where its structural composition has begun to deteriorate rapidly. There is a partial explanation in the chemical analysis of the virgin pig iron and of the repeatedly remelted scrap, but the modification of the chemical analysis produced by varying the percentages of virgin pig iron and scrap does not always represent the differences produced in the mechanical properties. These differences are related to the structural composition of the metal and to its degree of homogeniety.

In cupola melting the size of the scrap and its relative bulk in the pig plus scrap charge often plays an important part, just as the mixtures of fine and lumpy ore in the blast furnace burden may influence the character of the pig iron even when the chemical composition of the powdery ore and of the ore lumps is similar.

Consideration of the effects of scrap percentages in a cupola or air furnace charge results again in the conclusion that the structural composition of the product is the all-important question. It would appear that homogeneity of cast structure is the index to the quality of irons of similar chemical analysis. Just as the bulk analysis of molding sands of different grain size constituency may be closely similar, so the mean chemical analyses of cast irons of greatly different grain size and structural homogeneity may be approximately or closely alike. Taking the molding sand illustration again it may be noted that just as the addition of new sand to used floor sand in proper proportions enables a sand mixture to retain its properties so the use of virgin all mine pig iron in correct proportions in a pig iron plus scrap charge serves to regularize the structural properties of the cast product and to reduce the deteriorating influence of the added scrap. An illustration of the sulphur influence in deteriorating English white heart malleable, the result of repeated use of scrap from preceding melts, is shown in Fig. 4. In the same diagram the sulphur deterioration during the cupola melting of pig iron containing 0.08 per cent and scrap containing 0.10 per cent sulphur is given. In each cast the scrap used is assumed to be taken from the preceding melt, the sulphur addition per melt being estimated as 0.03 per cent. In actual practice of course the scrap produced is not sufficient for the succeeding melt and foreign scrap has to be purchased. If the latter could be guaranteed to contain as low a sulphur content as the pig iron the scrap from the succeeding melts would increase much more slowly in sulphur content.

The curves indicate clearly the approximate number of remelts required to reach the point when further remelts do not add much sulphur to the cast products. The maximum sulphur content is reached more quickly as the scrap percentage in the cupola charge increases. By the same method of attack, the influence of scrap proportions on grain growth in the metal cast from similarly remelted pig iron and scrap mixtures is capable of determination. The oxidation of the iron, silicon and manganese also can be progressively traced in relation to the number of remeltings and pig plus scrap proportions in the charges.

Somers, Fittler Todd Co., Pittsburgh, has been made sales agent for the Precision Grinding Wheel Co., Philadelphia.

Faked Foundry Facts

A Riser

Give New Nickel Silver Formulas

Some practical formulas for nickel silver are given by E. O. Jones and E. Whitehead in a paper presented before the American Institute of Mining and Metallurgical Engineers at Syracuse, N. Y., Oct. 5-9, 1925. These are as follows:

Analyses of Nickel Silvers

	Grade A Per Cent	Grade B Per Cent	Grade C Per Cent
Copper	61.25	65.50	60.40
Nickel	11.79	16.28	20.64
Zinc	26.02	16.30	19.34
Tin	0.126	0.094	0.095
Lead	0.05	0.04	0.03
Manganese	0.05	0.06	0.04
Iron	0.05	0.07	0.07
Sulphur	0.04	0.04	0.03
Carbon	0.10	0.11	0.08

Hold October Meeting

The October meeting of the Quad-City Foundrymen's association, held at the LeClaire hotel, Moline, Ill., Oct. 19, was devoted entirely to reports of the various technical sessions at the Syracuse convention of the American Foundrymen's association. The speakers were Hyman Bornstein, W. M. Thomas, Fred Kirby, Max Sklovsky, J. H. Diedsich, and A. E. Hageboeck. The latter gave a brief resume of the personal of the directorate of the American Foundrymen's association.

Michigan Foundries Grow

That Michigan rapidly is assuming a position of importance among the foundry states is indicated by a recent survey, which shows that 228 gray iron foundries are located in the state. About $5,000,000 is invested in these foundries, which includes a part of the plant equipment of companies producing automobiles. Between 35,000 and 36,000 persons are employed in this industry, while more than 6500 tons of iron is melted daily. According to a conservative estimate, in the neighborhood of 2,000,000 tons of pig iron, scrap and remelt is used annually in the state, 65 per cent of this being Michigan iron.

More than half of the total gray iron is melted in Detroit, where a large portion of the melt is made into stoves and the bulk into automobile castings. The largest foundry in the world, the River Rouge plant of the Ford Motor Co., is located in Detroit, this plant covering 30 acres and pouring more than 2000 tons of castings every 24 hours.

Patternmakers Need Hammers

Several Types Comprise List of Pounding Tools Needed by Woodworker

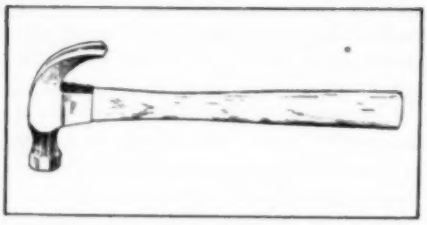


Fig. 1—The Claw Hammer Is the Chief Pounding Tool

Various Parts of Tool Are Hardened To Withstand Blows in Striking Nails

By Walter C. Ewalt

INCLUDED in the list of pounding tools used by the wood pattern maker are the claw-hammer, the long peen hammer, and the mallet while the nail set and the magnetic brad set also are considered under this class. These tools are familiar to almost everyone in a general way. However, there are many things in connection with this class of tools which makes them of considerable importance to those who use them daily. The woodworker wishes to know why these tools are of a certain shape and the reason for certain material being used in their construction. As a rule, these tools are taken for granted and are thought extremely common, nevertheless, there are many practical, one may say scientific, reasons for the construction of these tools, thus making them efficient with reference to lasting qualities as well as ease in handling.

The writer has found hammer stones near the place where the old village of the Fox and Sac Indians was situated on the Rock River in Illinois. It is useless to estimate their age but of course they are comparatively modern in comparison to the antiquarian stone hammers of Europe, Asia or Africa. However, one can imagine the Indians pounding their corn into meal, chipping the flints for arrows and working out with the hammer many of the common daily tasks, and then tomahawks were famed.

The form or shape of a claw hammer has been in use for many centuries, this type of hammer being shown in Fig. 1. It is used to drive nails in wood and also to withdraw them. The head is made of steel and the handle of hickory. The names of the different parts of the head are the face, the poll, the eye and the claws. The face is hardened so that it will stand the blows of striking the heads of the nails. The eye is designed to receive one end of the handle, and this part of the head is not hardened. The claws are hardened and are used to withdraw the nails. Hammers are forged of special steel which is hardened and tempered while many are made of a special cast steel called hammer steel and usually are satisfactory. The face should be

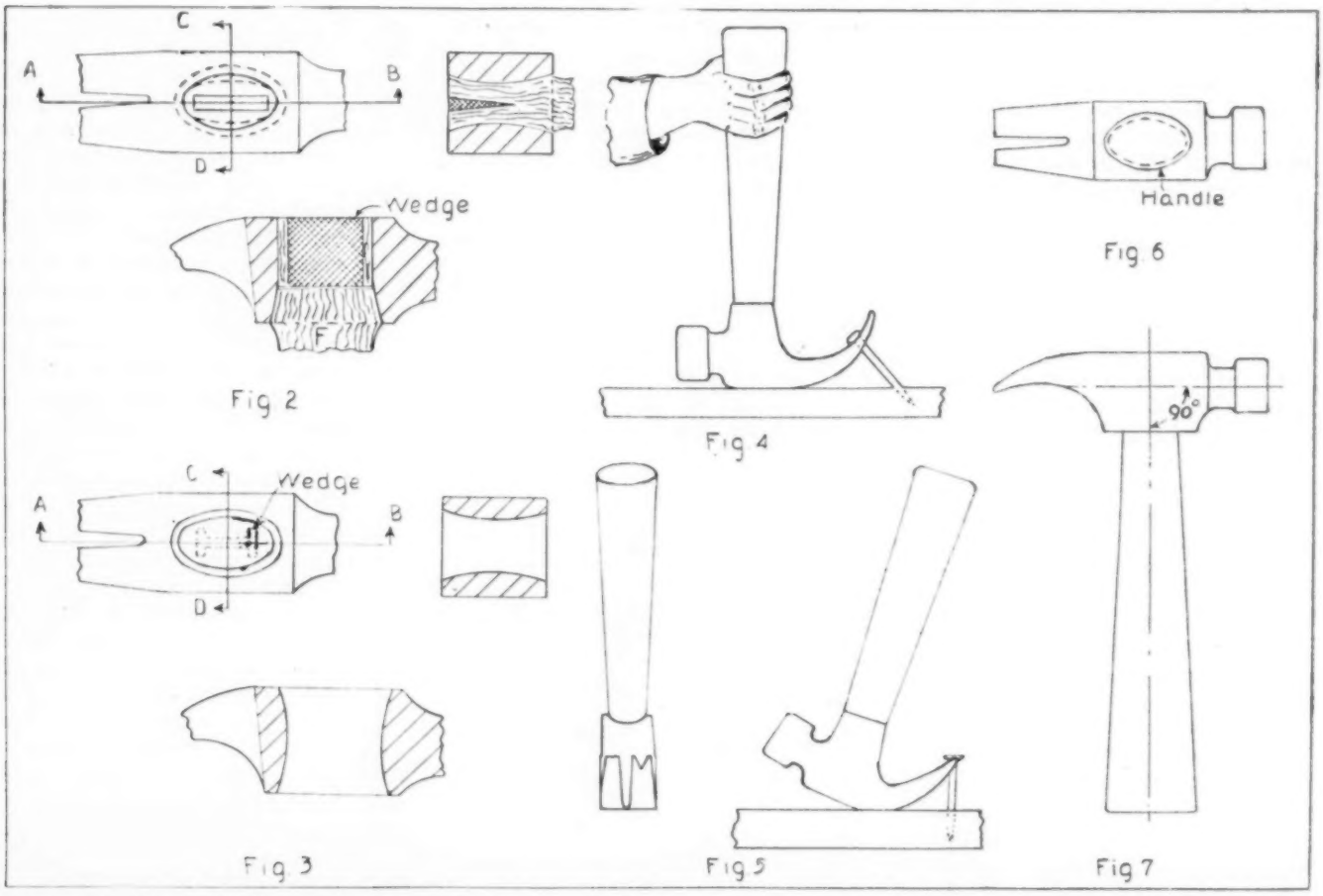


FIG. 2—SECTION SHOWING METHOD OF WEDGING THE HANDLE. FIG. 3—THE EYE IS MADE OVAL AND THE HOLE IS WIDENED. FIG. 4—CLAWS FOR PULLING NAILS. FIG. 5—USING THE CLAW AT THE END OF ONE CLAW. FIG. 6-7—THE HANDLE MUST BE SQUARE

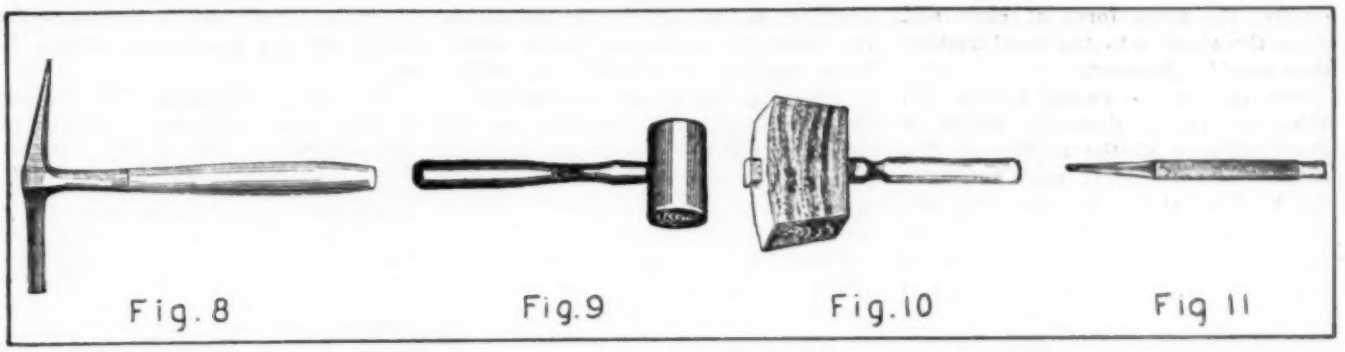


FIG. 8—PATTERNMAKER'S LIGHT HAMMER. FIG. 9—RAWHIDE MALLET. FIG. 10—HICKORY MALLET. FIG. 11—NAIL PUNCH

hardened to withstand the energy of the blow without bruising or mushrooming the edges but it also should not be so hard as to crack or chip. Hammering nails with the flat side of the head, next to the eye, is an extremely bad practice as that part of the steel is soft, and the repeated blows may expand the metal and loosen the handle, while often the handle is broken in this manner.

The face of the hammer is slightly convex, usually called bell or ball faced, and the edges are beveled. On first thought, one would think that if the face were flat, it would meet the head of the nail squarely but in practice this is not the case. However, some workmen prefer the face flat.

The eye of the hammer is shaped as shown in the accompanying illustrations to enable the handle to be wedged solid into the head of the hammer. In Fig. 2, owing to the particular shape, only one wedge is required, F in the side view representing the end of the handle. It will be noticed that the center of the eye is smaller than the ends. In the top view of Fig. 2 the sides flare out, this being plainly seen in sections C-D. Only one wedge is needed with this style of eye. The bottom view of Fig. 2 shows the handle end of the eye flares in both directions. In Fig. 3 the eye is made oval at each end and the hole is widened sidewise and lengthwise, this type necessitating three wedges.

Particular care should be taken in fitting the handle into the eye. The handle is made a tight fit in the opening shown in Fig. 2 and should extend out square both ways from the head. This is shown in Fig. 6 and 7. The oval of the handle is at right angles to the plane of the side elevation and also to the plane along a line from the center of the claws to the center of the face. At the hammer end of the handle, saw cuts are made which extend half way through the eye and in these cuts wedges are driven which lock the handle into the eye. Wedges are made of wood and sometimes of copper, the edges of which are roughened or serrated to keep them in place. The wedges should not be longer than the depth of the saw cuts in the handle, as shown in Fig. 2. The handle should be made from second growth white hickory.

Exercise Care in Fitting Handle

The claws are hardened. Their shape enables them to be placed under the head of a nail and using the handle as a lever and the part of the head, near the eye, as a fulcrum, the nail is pulled out of the wood. This operation is shown in Fig. 4. Sometimes an extra claw is filed in one of the claws, as shown in Fig. 5, to bring the fulcrum nearer the nail. Otherwise the end nearest to the face would act as the fulcrum and being too far away, a broken handle might result. The large claws are used first to withdraw the nail part way and then the extra claw is used. Claw hammers come in sizes from 5 to 20 ounces and are from 12 to 13½ inches long over all. A good size for a patternmaker is one weighing 13 ounces.

The face of the hammer should be kept clean from glue. Sometimes the face keeps glancing from the head of the nail. If such is the case, the face should be rubbed on a brick or sandpaper to roughen the surface of the face. When using the hammer, grasp it at the end of the handle and strike square, quick blows on the nail, snappy being the word which best describes the blow. Just before the last blow, use a nail set to set the head of the nail under the surface of the wood. Do not hit the wood with the face of the hammer and leave your Trade Mark.

The patternmaker's hammer shown in Fig. 8 is light and is sold according to the size of the face. The lightest sizes range from ¼ to 7/16 inch in diameter, and those somewhat heavier from ½ to ⅝ inch in diameter. This hammer is somewhat like the one described above but instead of the face and claws it has two faces one of which is round and the other oblong with which brads and nails may be driven in small tight places. The faces also extend further from the handle than is the case with the claw hammer, some of the faces being from 3 to 5 inches in length.

A mallet as shown in Figs. 9 and 10, is a hammer made of hedge, boxwood, apple, pear, dogwood, gum, beech, locust, lignum-vitae woods, rubber and rawhide. Mallets were found in the pyramids of Cheops and Ghizeh. One was also found in Thebes along with drills, bows, chisels, and oil horn, a saw and a nail bag. This collection is in the British Museum and was found by Mr. Burton, who says "these had been locked up in a dry and dusty tomb at a time when Greece had not felt the light of science and centuries before Romulus and Remus. Perhaps the workmen had been putting the finishing touches to some of the fittings of the tomb and accidentally left it inside when the door was closed as they supposed forever, or until the shell of the body was revived to receive its old tenant."

While it is true the mallet is a hammer, there is considerable difference between a metal hammer and one of wood, the difference being in the manner in which they absorb the force of the blow. A metal hammer takes up force almost immediately and the mallet accomplishes this more slowly as the material of which the mallet is made is yielding. If the hammer was used to strike the wood handle of the chisel, the handle receives the full force of the blow instantly and the handle may crack, as the soft material of the handle does not have time to absorb the shock. However, the material of which the mallet is made takes up some of the force in itself momentarily and thereby lessens the shock to the handle. As the time of the blow is lengthened, it allows the force used to extend to the cutting edge of the chisel. In

reality, the same force of blow will drive the chisel into the wood further than would a hammer.

The nail set is shown in Fig. 11. When the nail is driven to within a short distance of the surface of the wood, the nail set is used to drive the head of the nail under the surface. The nail set is made of steel and the point is hardened. Many of these have a concave point called cup points. The sharp edge penetrates the head of the nail slightly and prevents the set from slipping. If the nail drives in stubbornly and the set slips off, the nail may be driven in sometimes by holding the point ⅛ inch away from the head of the nail and striking the set in that manner. The head of the set is made soft purposely to avoid injuring the head of the hammer.

The magnetic brad set is more of a pushing tool than of pounding type. It consists of a handle and a hollow steel stem into which is placed a spring and a steel pin, the end of which is magnetized. The spring holds the handle away from a collar and also brings the end of the steel pin at the end of the tool back into the hollow shaft. A brad is placed in the hole left by the steel pin and is held there by magnetism. The brad is then forced into the wood by pushing on the handle. When the handle is released, the spring returns the handle and pin to their original position. There are many places where this tool is convenient while working on patterns and coreboxes in such places as fillets, in corners, and deep recesses where it is awkward to use a hammer and even in places where a hammer could not, at all, be used.

Inaccuracies Shown in the P. A.'s Slant

(*Concluded from Page* 907)

floating around in the back of his mind it is impossible to impress the purchasing agent favorably.

Mr. Dinsmore claims that any student of psychology could have pointed this out to the foundryman. The purchasing agent needs no help or assistance from any person. This ability to read human nature we are allowed to infer is a gift confined exclusively to his profession.

Suppose we accept Mr. Dinsmore's own statement concerning the infallibility of the student of psychology, let us see where a little further investigation will lead us with this student for a guide. The statement calmly is made that the lack of cordiality on the part of the purchasing agent is caused by the secret sentiments of dislike held by the salesman. An elaborate display of words sometimes enables a speaker or writer to create a temporary impression in his favor, but the decision is reversed when the words are reduced to cold type and subjected to the test of ordinary common sense. Every chain has a beginning and it is idle, although at the same time typical for a purchasing agent, to say that he can use certain links in the chain of argument and stop arbitrarily at any link that suits his purpose. Being only a foundryman I cannot pretend to read men's minds, but I can add two and two together and I can draw my own conclusions from the written or printed word when it is set down in words of a reasonable length and in the English language.

The foundryman is not in business for fun or for an excuse to go around with a chip on his shoulder. He does not make castings just for the pleasure of pouring iron, steel or brass into the molds. He makes castings to sell and since he is just an ordinary human being he appreciates the orders of his customers. Under normal conditions his relations with the man who buys the castings are satisfactory and friendly. He does not, "dislike the whole tribe of purchasing agents."

Strictly following Mr. Dinsmore's argument one man does not dislike another without cause and that brings us down to the first link in the chain, the link Mr. Dinsmore ignores.

Why does the foundryman dislike the purchasing agent?

To prevent any possible misconstruction, I am not refering to every purchasing agent, I am sticking strictly to the class with which I started, the purchasing agents who are responsible for the strained relations. The foundryman dislikes him because he cannot do business with him on a reasonable basis, because he is utterly selfish, without conscience, because he is not sufficiently familiar with the foundry industry to bargain in an intelligent manner, because he is too proud to admit his ignorance, but prefers to cover it under a hard boiled exterior. Finally, and this applies to nearly all purchasing agents, he has an exaggerated idea of his importance and insists on wearing the high hat before, during and after an interview with a salesman.

I might take up the remaining items in the series one by one and point out their inconsistency, but that would stretch this article to interminable length and as I stated in the beginning would serve no useful purpose since we are both set in our views. However, I cannot refrain from touching on one statement in the concluding article of Mr. Dinsmore's series. To quote:

The author complains that the purchasing agent frequently makes unjust demands for speedy delivery when the castings could just as well have been ordered far enough in advance to enable the foundryman to serve him well without undue cost. * * * * Let us assume that under these trying and uneconomical conditions he is getting 5 cents a pound for his castings and that the added cost is about ½ cent a pound. If he were to offer to sell castings for 4¾ cents a pound provided he could make them on his own schedule the purchasing agent would welcome this with open arms.

Wild chorus of approving shouts from assembled foundrymen. "Yes he would. NOT."

Why should foundrymen hold such a pessimistic view? Partly through their knowledge of purchasing agents and partly because the scheme has been tried and did not work out as anticipated—by the foundryman. Why did the scheme not work out? Mr. Dinsmore himself inadvertently furnishes the explanation in an earlier number. True he is discussing another point, but that does not change the fact that he holds a certain view.

Here is his statement:

A Victim complains that many purchasing agents cause the foundryman to lose their fair profits by changing sources of supply just when the foundry gets all set to make some money on the account. *That is one of the situations that all vendors must face.*

In other words after the purchasing agent has succeeded in maneuvering the foundryman into accepting a price of 4¾ cents for 5 cent castings, he calmly cancels the contract. Mr. Dinsmore does not give the reason, but almost any foundryman can furnish it from his own experience. He cancels it after he has used it as a club to secure the castings from another source for 4½ cents a pound.

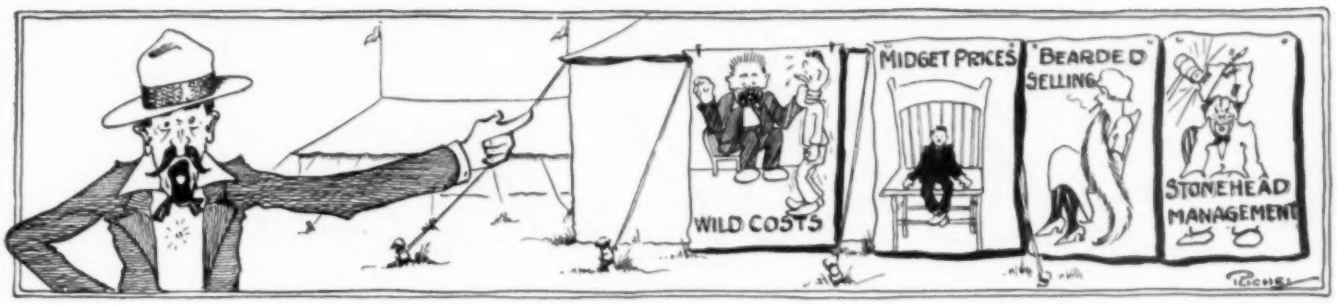
Finally, and this absolutely is the last word, I would ask you to contrast the following two statements taken not so far apart from the second article in this series:

His second consideration is to make sure that the vendor's price not only bears the proper relationship to the cost of production, but that these production costs are based upon good practice and are as low as they should be.

Now read this in which I have supplied the italics:

I've made an intensive study of the whole price fabric for many years and I'm firmly convinced that prices are fixed *not by cost of production, but by what the traffic will bear.*

Any man who can reconcile these two statements is a better man than I am Gunga Din.



Cutting Prices Never Won the WELL PADDED PANTS

P. T. Barnum Says/

THE history of money getting, which is commerce, is a history of civilization and wherever trade has flourished most, there, too, have art and science produced the noblest fruits.

WHEN one starts into the jobbing foundry business in any line, he can expect to be like that Pennsylvania senator who had been the target of many an unfriendly missle during his term in public office. That gentleman remarked in speaking about these attacks, "I have been kicked with fervor so many times that now I never even look around to see who does it." Running a jobbing foundry may be compared with the life of a senator only in one of its phases. In these days, when competition is so strong, the toe of some irresponsible competitor's boot never is far removed from the bosom of the average foundryman's trousers.

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ASK any jobber of castings and he will tell you that his own particular line is the toughest. He is firmly convinced that his path alone lies among the rocks and brambles, while the other fellow's is well paved, flower bordered and pleasant. Yet I doubt much if anyone would look upon the general brass foundry business within the metropolitan district of New York as attractive or more likely to produce a satisfactory income than his own line of manufacture. Brass shops in this region range from some representative plants that make plumbing goods on a production basis to the tiny, little, 2 by 4, garret foundries where a few workmen of foreign birth make candlesticks, door knockers and other art ware from all scrap mixtures.

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RECOGNIZED as the market center for both new and old nonferrous metals, this section also ranks high as a consuming territory and the buyers are canny. Which brings me to the point of this affair. Last week, I met in New York City a brass foundryman making general jobbing castings, stick brass and bushings, a man who, according to his competitors was never known to cut a price. I hunted him up, and where do you suppose I found him? Not tucked away in a wharfside shed, nor occupying the seventh floor of an east-side tenement, but comfortably established in the ground floor of a large office building in a good retail section. He owns the building he occupies, the one adjoining, is said to have a fine home, a good car, a bank account and the rest of the things that go to make up the possessions of those who have arrived at comfortable fortune.

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AS I stated, this affluent brass foundryman never has been known to cut a price. When I saw him, the foundryman, in question, a Scot, by the way, affirmed this report. He said, "A man buys castings only when he needs them. He doesn't look for them to satisfy a whim nor to gratify a pleasure. He needs them. Only so many castings are to be made. Why sacrifice a legitimate profit to give the buyer something that he must have." True, isn't it? Further, he knows his costs, from start to finish. If a buyer says that he can get the same goods cheaper at another place, he is advised to go there. Yet this foundry produces over 100 tons of castings a year and as the proprietor said, "I haven't had to look for a new customer in 16 years."

Phineas, Jr

The Shakeout

DAN M. AVEY, Managing Editor
PAT DWYER, Engineering Editor
CHARLES VICKERS, Nonferrous Editor
FRANK G. STEINEBACH, Associate Editor

¶ Buyers Query Gating Practice

YEARS ago a popular ballad of the day, whistled on the streets and strummed on those stringed instruments, shaped and striped like a potato bug, had a refrain which went something like this, "I don't know why I love you, but I do-oo-oo." Nothing more nearly fits the average layman's idea of why a foundryman prefers his own peculiar way of gating a pattern. According to popular belief, insistence upon certain gating is entirely tempermental, marking the foundryman as a bit eccentric, and one inclined to place undue stress upon trifles.

A recent issue of a business magazine presents the views of a purchasing agent who buys a considerable tonnage of castings for his firm. This gentleman, although he has had long contact with the industry and doubtless is familiar with foundry practice in a number of shops, believes he is making a valuable suggestion when he advises uniform methods of gating identical or similar patterns. This same proposal has been made before—many times. In fact it has been the subject of discussion among technical men connected with the industry, but not in the operating end. Unfortunately, the matter of different gating is not one which can be solved by disregarding or overriding the mere preferences of those who make the castings.

THOSE who buy castings and who from time to time move their work from one shop to another are familiar with the frequency with which changes are made in pattern details. Usually these changes have to do with the placing, the type or the size of gates. Some are inclined to think that this irregularity is due to the inate contrariness of foundrymen. Again, statements have been made that this changing is induced by a desire of the foundrymen to put something over on the purchaser; to make the latter think he is getting something more for his money.

PERHAPS some of the blame for this lack of regularity may be laid at the door of the foundryman's individuality. He has nothing to gain by seeking to impress a customer by making a change, merely to be different. The need for these changes is real. It is based upon different shop conditions, upon habit, upon the factor of morale which is maintained by avoiding practices which are unique to the workmen, and finally upon the different metal temperatures.

¶ Who Bears the Burden

FOREIGN visitors to this country find a never ending source of wonder in the low price of automobiles, the immense number in use and the prodigal manner in which they have been sprinkled over the length and breadth of a land that has learned to endure their honking horns from the rising of the sun to the going down of the same—and in the period between. Those abroad engaged in the production of automotive parts, knowing as they do their manufacturing costs, share this attitude to a marked degree. Commenting on the subject recently one British maker of cylinder blocks expressed the belief that the low cost of automobiles is due to the low prices paid for parts.

WHILE this foundryman's opinion of the American ability to produce quality cylinders at a high rate of speed was decidedly complimentary, his opinion of the business ability of the jobbing foundrymen engaged in making this class of castings was not so high. He stated that in England where the price of iron practically is the same as it is in the United States, with lower labor costs and with methods which do not differ in any marked degree, cylinder castings bring more than twice as much per pound as those made in American foundries. He admitted that the larger production on this side of the water automatically lowers the overhead expense per unit, but it is in no way sufficient to account for the disparity in prices obtaining in the two countries. Is it true that forcing down the prices paid to those who furnish parts or material is the main factor responsible for the comparatively low cost of American automobiles?

Trade Outlook in the Foundry Industry

CONTINUED improvement is noted in foundry operations in line with the pickup in practically all lines. Manufacture is increasing at a heavy rate. This leads some jobbing shops to question the continued demand from large manufacturing plants that operate foundry departments. Usually these firms buy castings during slack periods, being able to obtain prices from independent sources which are lower than can be obtained in their own establishments. This is due in a large measure to the increased overhead incident to decreased operation. With improved business much of this work is expected to return to the customers' own foundries.

Freight Mounts

Railroad shipments continue to break all records. The greatest loading of revenue freight for any period from Jan. 1 to the middle of October was marked this year with a total of 41,171,601 cars. Further the total for the week ending Oct. 24 was 1,121,459 cars, the greatest number loaded for any week on record, with the single exception of one week in August this year. Purchases of railway equipment have been desultory, and while some new inquiries are extant, builders of cars expect next year to reap the fruits of the present prosperous condition. An increase in the number of bad order cars, requiring heavy repairs is noted. This factor, coupled with the continued high rate of loading, and the exceptionally heavy tonnages per car mile cannot fail to produce car business in the near future. At present business among railroad equipment foundries is improving. Undoubtedly, some of this is coming from repair demand, but a fair amount may be traced to new car and anticipated new car business. September led the year for the total of new car awards, the orders almost reaching 8000. Slight increases are noted in inquiries for locomotives.

Prices for Raw Materials for Foundry Use

CORRECTED TO NOV. 7

Iron		Scrap	
No. 2 foundry, Valley	$20.50	Heavy melting steel, Valley	$18.50 to 19.00
No. 2 Southern, Birmingham	21.00	Heavy melting steel, Pitts.	19.00 to 19.50
No. 2 foundry, Chicago	22.50 to 23.00	Heavy melting steel, Chicago	16.00 to 16.50
No. 2 foundry, Philadelphia	23.26 to 23.76	Stove plate, Chicago	17.25 to 17.75
No. 2 foundry, Buffalo	20.50 to 21.00	No. 1 cast, Chicago	20.50 to 21.00
Basic, Valley	20.00	No. 1 cast, Philadelphia	18.50 to 19.00
Basic, Buffalo	19.50 to 20.00	No. 1 cast, Birmingham	16.00 to 17.00
Malleable, Chicago	22.50 to 23.00	No. 1 cast, Buffalo	18.50 to 19.00
Malleable, Buffalo	20.50 to 21.00	Car wheels, iron, Pittsburgh	18.50 to 19.00
Coke		Car wheels, iron, Chicago	18.00 to 18.50
Connellsville foundry, coke	$8.50 to 9.00	Railroad, malleable, Chicago	19.25 to 19.75
Wise County foundry, coke	5.00 to 6.00	Agricultural, mal., Chicago	17.00 to 17.50
		Malleable, Buffalo	19.00 to 19.50

Pig Iron Advances

Production of pig iron showed a marked increase according to statistics compiled by the *Iron Trade Review*. The total output of all grades of iron in October was 3,017,889 tons, compared with 2,725,885 tons for September, giving a gain of 10.7 per cent. On a daily average basis, the October production of 97,351 tons per day was 7.1 per cent ahead of the preceding month's make of 90,862 tons per day. Merchant iron showed a gain of 36,873 tons, the production for September being 569,219 tons against 606,092 tons for the month just past. The daily average production of merchant iron was 19,551 tons in October and 18,974 tons in September. Nine more blast furnaces were active on Oct. 31 than at the end of September, while the merchant furnaces alone showed a gain of four. Prices of iron show some tendencies to strengthen. A noteworthy feature is the insistence of buyers upon immediate shipment of standing requirements and early delivery of orders which are being placed at this time. Coke is advancing.

Factors Favorable

Practically all signs point to a continuation of the present demand for castings, with probable improvement. Jobbing foundries in the east are working at better than 60 per cent of capacity. The building construction outlook is favorable, as residence and commercial operations continue and improvement is at hand in factory and industrial types of structures. Farm conditions never have been better, since the slump of 1920. In consequence the purchases of all classes of farm machinery, trucks and tractors in the rural districts are increasing. Finley P. Mount, president of the National Association of Farm Equipment Manufacturers, in addressing the thirty-second annual convention of that organization held in Chicago Oct. 28 to 30 stated that it will take several years to replace the wornout equipment now on the farms. Slight improvement is noted in malleable foundry operation, although this branch of the industry has been working at only about fifty per cent of capacity during the entire year. According to the department of commerce, the orders booked during September amounted to 51.3 per cent of capacity of all the plants reporting. A comparison of 130 identical plants shows operations at 51.7 per cent compared with 50.0 per cent of capacity during the preceding month.

Nonferrous Operations

Brass jobbing foundries making miscellaneous machinery sundries are busy. Those specializing in automotive parts also are busy. Plumbing goods demand is well sustained. New York prices for nonferrous metals, according to the *Daily Metal Trade* of Nov. 7, follow: Casting copper, 14.12½c; electrolytic copper, 14.87½; Straits tin, 63.25c; lead, 10.00c to 10.25c; antimony, 20.12½c; nickel, 38.00c; aluminum, No. 12 alloy, producers' price, 27.50c and remelt, 25.00c to 25.50c. Zinc is 8.95c, E. St. Louis, Ill. Average monthly prices for September follow:

New York Prices

Castings Copper	Electrolytic Copper	Lead	Tin Straits	Antimony	Aluminum 98-99	Zinc St. Louis
13.813	14.544	9.589	62.258	17.923	27.285	8.328

Comings and Goings of Foundrymen

ROBERT E. KENNEDY, who was in charge of the successful technical sessions at the Syracuse meeting of the American Foundrymen's association, has been allied with some phase of the foundry industry since 1909. He was born in Vincennes, Ind., in 1887, and after receiving his common and high school education, was graduated in 1909 from the Winona Technical institute, Winona Lake, Ind., taking a trade course in foundry practice, and later from the University of Illinois, Urbana, Ill., with a course in industrial education. From 1910 to 1917 he was instructor in foundry practice at the University of Illinois, and from 1919 to 1921 he was assistant professor in charge of foundry practice. During the summer vacations at the university he was engaged in foundry work in the following plants: 1911, chemist, Mitchell Motor Car Co., Racine, Wis.; 1912, molder, Rumley Oil Pull Tractor Co., Laporte, Ind.; 1913 coremaker, Stove Gas Engine Works, Freeport, Ill.; 1914, molder, Central Foundry Co., Vincennes, Ind.; 1915-1916, time study work, Packard Motor Car Co., Detroit; 1917, assistant foundry superintendent, Dunham Co., Berea, O.; and 1920, mechanical methods engineer, Hawthorne works, foundry department, Western Electric Co., Chicago. During the war he spent a period in the steel foundry at the Watertown, Mass. arsenal. After being discharged from the army in 1919, he was appointed assistant superintendent of the United States training service, foundry training, department of labor, and prepared United States training service bulletin No. 24 "Industrial Training for Foundry Workers." On completion of this work he returned to the University of Illinois as superintendent of the foundry. He was appointed assistant secretary of the American Foundrymen's association in 1921. In addition to the regular work as assistant secretary, he has acted as secretary of the joint committee on molding sand research, secretary of the joint committee on pattern equipment standardization and secretary of the joint committee on foundry refractories. He is a member of the American Foundrymen's association, the Society of Mechanical Engineers and an associate member of the American Institute of Mining and Metallurgical Engineers.

Following the resignation Nov. 1 of John H. Bode, vice president in charge of operations for the Mackintosh-Hemphill Co., Pittsburgh, to become president of the Wellman-Seaver-Morgan Co., Cleveland, the Mackintosh-Hemphill company announced that C. V. Wilt has been placed in charge of operations in the capacity of assistant to the president, J. Ramsey Speer. A. H. Baum has been made second assistant to the president.

L. A. Dunn, formerly connected with the Wilmington plant of the Eastern Malleable Iron Co., Naugatuck, Conn., and for the past 3½ years foundry superintendent of the Laconia Car Co., Laconia, N. H., recently has been made superintendent of the Temple Malleable Iron & Steel Co., Temple, Pa.

ROBERT E. KENNEDY

Walter J. Kenney has been appointed superintendent of the foundry of North & Judd Mfg. Co., New Britain, Conn., to succeed his father Martin H. Kenney, who died recently. W. J. Kenney has been assistant superintendent for several years. He was graduated from the Rensselaer Polytechnic institute in 1921.

W. Scott Thomas, for 23 years connected with the sales department of J. W. Paxton Co., Philadelphia, and for the past 14 years manager of the New England branch of that company, has resigned to enter business for himself as a manufacturer's agent with headquarters in Providence, R. I.

A. L. Humphrey and Hamilton Stewart have been elected trustees of the University of Pittsburgh, Pittsburgh, it was announced yesterday. Mr. Humphrey is president of the Westinghouse Airbrake Co. and was formerly president of the chamber of commerce. Mr. Stewart is vice president of the Harbison-Walker Refractories Co. Both have been active in the university building fund campaign.

John Martinelli now is connected with the Wilson Foundry & Machine Co., Pontiac, Mich. Mr. Martinelli recently graduated from a midwestern university receiving the degree of bachelor of science in mechanical engineering. During summer vacations while attending the university he worked in the foundries of the American Locomotive Co., Schenectady, N. Y., and becoming greatly interested in foundry work he decided to become better acquainted with the work of the industry. At present he is working through the various departments of the Wilson plant, starting in the sand mixing room.

To Extend Field

The Milwaukee Electric Crane & Mfg. Co., Inc., a New York corporation doing business at Milwaukee, has been reorganized under the laws of the state of Wisconsin as the Milwaukee Electric Crane & Mfg. Corp., with an increase of capital stock from $300,000 to $400,000 preferred stock and from 7000 shares to 8000 shares of common no-par value stocks.

The Wisconsin corporation has acquired all of the property and business of its predecessor, which represents in the neighborhood of $1,000,000 in real and personal property. The new company is preparing to largely increase its business and extend its field of operations. The officers of the new corporation are as follows: M. A. Beck, president; Henry S. Wright, vice president; A. J. Pitman, vice president; M. P. O'Brien, secretary-treasurer. These men with the addition of Henry M. Thompson compose the board of directors.

Will Hold Convention

The annual meeting and convention of the National Founders association will be held on Nov. 18 and 19 at New York. The convention dinner will be held at the Astor hotel on Wednesday evening, Nov. 18.

On Wednesday the main feature of the sessions will be the conference between agricultural, industrial and transportation executives to discuss practical methods of promoting economy in state and local administrative expenditures and the reduction of taxes. The complete program is as follows:

Wednesday, Nov. 18
MORNING

Conference between agricultural, industrial and transportation executives.
Why This Conference, by William H. Barr, president, National Founders association.
Who Pays the Taxes, by James A. Emery, counsel, National Founders association.
Taxes: The Great American Crop, by William J. Thompson, National grange, South China, Maine.

AFTERNOON

Taxation as a Family Burden, by Allan Robinson, president, Commonwealth Bond Corp., New York.
How Taxes Affect Railroad Costs, by R. H. Aishton, president, American Railway association, Washington.
Tax Control through State and Local Group Action, by C. A. Dyer, Ohio State Farm bureau, Columbus, O.

EVENING

Convention Dinner, William H. Barr, toastmaster; Address, Some Sinners I Have Met, by Douglas Malloch, Chicago.

Thursday, Nov. 19
MORNING

Reports of officers.
Report of committee on industrial education.
The Need for Improved Foundry Methods to Overcome Foundry Labor Shortage, by H. M. Lane, H. M. Lane Co., Detroit.
Industry and the Public Schools, by L. A. Hartley, director of education, National Founders association.
Report of resolutions committee.
Report of finance committee.
Election of officers.
Adjournment.

President Is Elected

J. M. Price has been elected president of the Electro Metallurgical Sales Corp., New York. William J. Priestley, formerly metallurgical engineer at Pittsburgh, has been elected vice president to succeed Mr. Price. Both Mr. Price and Mr. Priestley will be located in New York.

Plan Pittsburgh Plant

The American Brake Shoe & Foundry Co., New York, may enter the Pittsburgh territory with its own plant and equipment for the manufacture of its special products. This company operates 15 foundries in various parts of the United States and the Pittsburgh plant will make the sixteenth. At present, brake shoes for customers in the Pittsburgh district are made at Buffalo and Baltimore. The Southern Wheel Co., manufacturers of chilled iron car wheels, with headquarters in Pittsburgh, which purchased the old National Car Wheel Co. about two years ago, is a subsidiary of the American Brake Shoe & Foundry Co.

Standardize Shovels

Elimination of more than 4000 sizes, finishes and varieties of shovels was approved recently at a meeting of the manufacturers, wholesalers, retailers and representative users held under the auspices of the department of commerce, in connection with the joint meeting of the American Hardware Manufacturers' association and the National Hardware association of the United States held at Atlantic City, N. J. The shovel institute, which has been studying this field for more than two tears, presented a tentative program calling for a reduction from 223 to 127 sizes. The report called attention to making shovels in five finishes and four grades, and advised that some of these be eliminated. The conference voted to eliminate one grade and all but one finish. The only exception in the reduction of the finishes was made in behalf of the iron molding industry, it being represented that a polished shovel was a factor in saving the time of workmen in foundries. The reductions will be effective May 1,1926.

Loam Practice Covered

STARTING with the issue of Dec. 1, THE FOUNDRY *will present a complete and interesting series of articles by Ben Shaw and James Edgar, covering the subject of loam molding. The authors, who are well known contributors to the technical literature of this country and Great Britain, will be remembered for their exhaustive writings on ship castings which appeared in* 1919 *and on motor castings in* 1922 *issues of* THE FOUNDRY. *The loam molding articles will illustrate the basic principles, the mode of operation, the best modern practice and the materials, equipment and rigging involved.*

Made Chicago Manager

F. M. Cross, formerly manager of the New York pneumatic tool department of the Ingersoll-Rand Co., New York, has been made manager in the Chicago territory.

Move Sydney Office

The office of the Sullivan Machinery Co., Chicago, in Sydney, New South Wales, has been moved from Australasia chambers, 3 Martin place, where it has been for 15 years, to Kembla building, Margaret street.

Joins Sales Force

Wilbur R. Maher has joined the New York sales organization of E. Arthur Tutein Inc., 52 Vanderbilt avenue of that city. Mr. Maher had been for many years with Rogers Brown & Co., first at Boston and later at Buffalo.

Appoint Representative

W. C. West Co., 14 East Jackson boulevard, Chicago, has been appointed district representative for the Decatur Malleable Iron Co., Danville Malleable Iron Co. and the Allith-Prouty Co., Danville, Ill., manufacturer of hardware specialties.

Addresses Foundrymen

S. R. Vanderbeck, sales manager at Philadelphia of the Whiting Corp., Harvey, Ill., addressed the Philadelphia Foundrymen's association Oct. 14, on new equipment for charging cupolas and doing other foundry work. A report of the activities at Syracuse also was given.

Obituary

Martin H. Kenney, superintendent of the North & Judd Mfg. Co., New Britain, Conn., died recently. Mr. Kenney was born in Sharon, Conn., and became connected with the North & Judd company about 30 years ago in the capacity of brass molder.

Robert Palmer Queen, superintendent of the Mt. Vernon Car Wheel Co., Mt. Vernon, Ill., since 1902, died Oct. 28, aged 54. Mr. Queen was born and spent his early life in Bardstown, Ky. During the past two years he had been busy assisting the planning and directing the construction of the new foundry of the Mt. Vernon company, which now is about ready to start operations.

A. B. Rawn has been made vice president of the Wilson Sand & Supply Co., Huntington, W. Va., to succeed Charles R. Wilson, retired. Mr. Rawn will assume management of the company Dec. 1.

New Buying Movement Develops

October Sales Show Substantial Increase as Buyers Enter Market for New Foundry Equipment—Value of Exports Declines in September

OCTOBER registered a marked improvement in the sales of foundry equipment in every large distributing center in the country. While a few individual companies have had better months during the year, the total business closed probably exceeded the monthly average for the first seven months of 1925. Much of this improvement is attributed to better operating conditions among foundries generally, while a bright prospect for heavier foundry business in the near future is a contributing factor to the display of greater interest.

Inquiries for equipment are being introduced at an exceptionally good rate and many prospects appear anxious to make an early decision. Equipment is being bought on the strength of performance, more than ever before. Foundrymen appear anxious to find means to cut costs of castings, to meet the heavy competition in the field. Repair business continues heavy.

Exports of foundry and molding equipment declined in September, the value of exports being $49,658 as compared with $59,772 in August, and $79,627 in September, 1924. The exports for the nine months ended September was $504,453 as compared with $406,123 in the corresponding period last year.

Unfilled orders for foundry equipment on Sept. 1, show a considerable increase over the value reported for Aug. 1, and the value for Sept. 1, 1924, according to the department of commerce. Unfilled orders for Sept. 1 were valued at $598,-143 as compared with $457,925 on Aug. 1 and $378,016 on Sept. 1 last year. August sales totaled $580,865 as against $353,561 for July and $244,408 for August last year. Shipments in August totaled $388,371 as compared with $352,-603 in July and $284,607 in August, 1924.

Inquiries Brighten Future Prospects

STIMULATED by the exhibit at Syracuse and by gradually improving demand for castings, New England foundrymen have been active buyers of equipment during the past ten or 15 days. More than a dozen New England foundries have bought molding machines. Prominent among recent buyers are the Poughkeepsie Foundry & Machine Co., Poughkeepsie, N. Y., the Kennedy Foundry Corp., Baltimore, Md., the Connecticut Foundry Co., Rocky Hill, Conn., the Yale & Towne Mfg. Co., Stamford, Conn., Hunt Spiller Mfg. Co., South Boston, the New England Foundry & Machine Co., Campello, Mass., and the United States Aluminum Co., Fairfield, Conn., each of which has purchased a sand machine from the Royer Foundry & Machine Co., Wilkes-Barre, Pa., in addition to considerable other equipment. The General Electric Co., Lynn, Mass., bought sandblast equipment from Alexander Haigh, Boston. Sandblast equipment has been purchased by the Barstow Stove Co., Providence, R. I. from the Pangborn Corp., Hagerstown, Md. The Gurney Heater Co., Framingham, Mass., has secured shakeout bails from the Stoney Foundry Engineering & Equipment Co., Cleveland, while the Leonard Baker Stove Co., Taunton, Mass., has taken tumbling mill equipment from the W. W. Sly Mfg. Co., Cleveland. The U. S. Naval Torpedo station, Newport, R. I., has contracted for a cupola from the Whiting Corp., Harvey, Ill.

Pittsburgh Volume Heavier

FOR several weeks past, demand for foundry equipment in the Pittsburgh area has been on the up-grade and it is claimed by some manufacturers and sellers that this industry never was in such a healthy condition as at present. Barometric as is the molding machine business, the statement of the Herman Pneumatic Machine Co., Zelienople, Pa., operating 100 per cent for some time past, is typical. It claims that October was the largest month of its history in incoming orders and in the development of new inquiries. On Nov. 1 it carried over more unfilled orders and more pending inquiries than ever before. Its recent business has come from well scattered points, and numerous inquiries from diversified users indicate health in many different lines of endeavor. Orders from this district include one each from the Gleason Works, Rochester, N. Y.; the A. P. Smith Mfg. Co., East Orange, N. J.; the Keystone Driller Co., Beaver Falls, Pa.; the American Locomotive Co., Chester, Pa.; the Clark Bros. Co., Olean, N. Y.; and the Sharples Separator Co., West Chester, Pa. Cupola orders received by the Whiting Corp. Harvey, Ill., have increased in number. The Conemaugh Iron Works, Blairsville, Pa., ordered a 72-inch cupola; the Crane Co., Ltd., Montreal, Que., the Dixie Foundry Co., Cleveland, Tenn., and the Vesta Gas Range & Mfg. Co., Chattanooga, Tenn., each have taken one, and the Iron City Sanitary Mfg. Co., Pittsburgh, two. It is understood that the Packard Motor Car Co., Detroit, has purchased several cupolas from the same manufacturer. The J. S. McCormick Co., Pittsburgh, reports a large amount of interest current in its blast volume meter for cupolas to measure the quantity of air, the Phillips & Buttorff Mfg. Co., Nashville, Tenn., being a recent purchaser. This foundry equipment dealer sold six ladles to the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.; three ladles to the Richmond Radiator Co., Uniontown, Pa.; a sand mixer to the Lorain Steel Co., Johnstown, Pa., and a special motor generator set to a local inventor who is an airplane engineer at work on a new development. Sand mixers have been sold to the Holland Furnace Co., Bethlehem, Pa., by the National Engineering Co., Chicago. The Pressed Steel Car Co., McKees Rocks, Pa., has ordered shake-

out bails and the Richmond Radiator Co., Uniontown, Pa., vibrator and shakeout equipment from the Stoney Foundry Engineering & Equipment Co., Cleveland. Sandblast equipment has been purchased by the Harrisburg Pipe & Pipe Bending Co., Harrisburg, Pa. from the Pangborn Corp., Hagerstown, Md. The W. W. Sly Mfg. Co., Cleveland, has sold sandblast mills to the Fort Pitt Malleable Iron Co., Pittsburgh. The Iron City Sanitary Mfg. Co., Zelienople, Pa., is expected to be heard from shortly with orders for tumbling barrels, core ovens, flask equipment, etc., and a foundry in Tarentum, Pa. and one near Steubenville, O. as well as the Howard Stove Co., Beaver Falls, Pa., are to place their core oven orders soon. A foundry interest near Steubenville, O. which has been negotiating for core ovens for about a year has not been heard from recently. The Mt. Morris Valve Corp., Mt. Morris, N. Y., is expected to buy equipment for a brass valve fitting foundry soon. Recent crane orders include a 5-ton with 58-foot span for the Lancaster Iron Works, Inc., Lancaster, Pa., ordered from Niles-Bement-Pond Co., New York, which also sold a 5-ton 3-motor crane with 58-foot span to the Oil City Boiler Works, Oil City, Pa. Through Frank D. Chase, Inc., Chicago, engineer, the Bessemer Gas Engine Co., Grove City, Pa., has ordered ten 1½-ton jib cranes and nine 1½-ton electric hoists.

Chicago Sales Gain

OCTOBER business in the foundry equipment market in the Chicago district was distinctly better than the monthly average to date, but fell slightly under the September level. The Cadillac Malleable Iron Co., Cadillac, Mich. has purchased a sand mixer from the National Engineering Co., Chicago. Shakeout bails have been purchased by the John Deere Harvester Works, East Moline, Ill., and vibrator and shakeout equipment has been secured by the Waterloo Gasoline Engine Co., Waterloo, Ia., the American Steel Foundries, Granite City, Ill., the Studebaker Corp., South Bend, Ind., and the Holmes Foundry Co., Port Huron, Mich., from the Stoney Foundry Engineering & Equipment Co., Cleveland. The Clinton Lock Co., Clinton, Ia., has secured sandblast equipment and the Illinois Malleable Iron Co., Chicago, has purchased dust arrester equipment from the Pangborn Corp., Hagerstown, Md. Tumbling mill equipment has been contracted for by the Link-Belt Co., Indianapolis, Ind., the Lackey Foundry Co., Muskegon, Mich., and sandblast mills have been taken by the Lincoln Foundry Co., Lincoln, Nebr., from the W. W. Sly Mfg. Co., Cleveland. The Saginaw Products Co., Saginaw, Mich., has purchased several cupolas and core oven equipment from the Whiting Corp., Harvey, Ill. That manufacturer also has sold a cupola to the Sparta Foundry Co., Sparta, Mich., two tumbling barrels to Johnson & Jennings Co., Chicago, several ladles to the Marshall Car Wheel & Foundry Co., Marshall, Tex., and a 20 and a 5-ton crane to the Missouri, Kansas & Texas railroad, St. Louis. The Clark Equipment Co., Buchanan, Mich., has purchased two 42 x 66-inch tumbling mills from the J. S. McCormick Co., Pittsburgh. The Nugent Steel Castings Co., Chicago, and the Colorado Fuel & Iron Co., Pueblo, Colo., have purchased two molding machines from the Herman Pneumatic Machine Co., Zelienople, Pa., while the Milles Foundry Co., Chicago, the Arkansas Foundry Co., Little Rock, Ark. and the Northwestern Malleable Iron Co., Milwaukee, each has secured one machine from the same manufacturer.

East Has Great Improvement

FOR the first time in many weeks foundry equipment buying in the New York metropolitan district has shown a decided improvement. The gain has been by no slight margin, which has left half the trade wondering whether such increase actually took place, but by a substantial margin which has left no doubt in the mind of anyone. With few exceptions, orders have been small, but they have aggregated a good total, and the volume of live inquiries is swelling steadily. Sellers generally believe this month will be one of the best this year. Underlying this improvement has been the slight, but steady gain in foundry operations over the past few weeks, along with a much more encouraging outlook. The approaching winter and the optimistic predictions for the iron and steel industry as a whole, some of which already are being fulfilled, has improved sentiment among equipment manufacturers. A recent buyer has been the New York Central railroad, which has closed on equipment for its foundry at Frankford, N. Y., including a cupola, reported placed with the Whiting Corp., Harvey, Ill. and a core oven. One of the largest buyers of late has been the Lennox Furnace Co., which has closed on complete equipment for a new foundry at Syracuse, N. Y. Most of this business, it is understood, went to the Whiting Corp. The De Matia Foundry & Machine Co., Clifton, N. J., has purchased several items, including a sandblast machine from the American Foundry & Equipment Co. and a tumbling barrel from the Whiting Corp. The International Motors Corp., New Brunswick, N. J., has bought a sand mixer from the National Engineering Co., Chicago. Sand mixers also have been contracted for by the Clark Bros. Co., Olean, N. Y., from the National Engineering Co. The Richardson & Boynton Co., Dover, N. J., has purchased four large molding machines from the Herman Pneumatic Machine Co., Zelienople, Pa., and the A. P. Smith Mfg. Co., East Orange, N. J., has secured one machine from the same manufacturer. Shakeout bails have been sold to the Utica Heater Co., Utica, N. Y., by the Stoney Foundry Engineering & Equipment Co., Cleveland. Sandblast equipment has been purchased by the General Electric Co., Schenectady, N. Y., from the Pangborn Corp., Hagerstown, Md., and the American Brake Shoe & Foundry Co., Baltimore, has taken tumbling mill equipment from the W. W. Sly Mfg. Co., Cleveland. A prospective buyer is the Gates Foundry Co., Wilkesbarre, Pa., which recently has awarded a contract for a $40,000 addition.

Cleveland Sees Improvement

SALES of foundry equipment throughout the Cleveland territory have shown a marked increase during the past few weeks. October volume of business was heavy, one manufacturer reporting that with the exception of March, the month just past was the best of the year. Inquiries are being brought out in good volume, and men of the trade feel that the remainder of the year will be exceptionally satisfactory for practically all lines of equipment used in the foundry. Shakeout bails have been sold to the Ferro Machine & Foundry Co., Cleveland, the Humphryes Mfg. Co., Mansfield, O., the Columbia Sanitary Mfg. Co., Louisville, Ky., and the Clyde Engineering Co., Sydney, Australia, by the Stoney Foundry Engineering & Equipment Co., Cleveland. The D. L. Auld Co., Columbus, O., has closed on sandblast equipment and the Gray & Dudley Co., Nashville, Tenn., on dust arrester equipment from the Pangborn Corp., Hagerstown, Md. Tumbling mill equipment has been sold to the Rome Stove & Range Co., Rome, Ga., and the Farrell-Cheek Steel Foundry Co., Sandusky, O., by the W. W. Sly Mfg. Co., Cleveland, that company also receiving orders for a sandblast room from the Delco Light Co., Dayton, O. Two molding machines have been sold to

the Bonney Floyd Co., Columbus, O., and one to the Toledo Machine Tool Co., Toledo, O., by the Herman Pneumatic Machine Co., Zelienople, Pa. The National Engineering Co., Chicago, has received orders for sand mixing machinery from the Frontier Iron Works, Buffalo, and the General Electric Co., Erie, Pa. The Ford Motor Co., Detroit, has purchased two 15-ton electric furnaces for the River Rouge plant from the American Bridge Co., New York, the equipment to be used in the manufacture of cylinder blocks. Repair business is good.

What the Foundries Are Doing

Activities of the Gray Iron, Malleable, Steel and Brass Shops

Lennox Furnace Co., Marshalltown, Iowa., will build an addition 80 x 100 feet. General contract to Leon Will, Marshalltown.

Martin Mfg. Co., Oak Hill, St. Louis park, Minneapolis, will rebuild its foundry and machine shop recently burned.

Arkansas Foundry Co., Little Rock, Ark., is building an addition to its foundry plant 60 x 150 feet.

Hewitt Co., E. Hill, manager, South Ninth avenue, Maywood, Ill., will build a 1-story steel foundry 40 x 60 feet.

Rosedale Foundry Co., Northside, Pittsburgh, suffered loss by fire which destroyed part of its plant.

The Blackmer Rotary Pump Co., which has moved its main offices to Grand Rapids, Mich., from Petoskey, Mich., will erect a large foundry building at the latter city.

Morgan Brass Mfg. Co., William McNamara manager, 2104 Woodland avenue, Cleveland, will build a 1-story foundry and machine shop 100 x 200 feet and 24 x 100 feet.

Advance Brass Foundry Co., 1208 Cass avenue, St. Louis, has been incorporated with $12,000 capital by Louis O. Strotz and John J. Czarnecki.

Maytag Washing Machine Co., Newton, Iowa, T. L. Maytag president, is having plans made for a foundry addition 190 x 280 feet.

Wetter Pipe Co., Gadsden, Ala., is completing and will start operations shortly in its new cast iron pipe and soil fittings plant. (Noted July 1).

Triangle Tool & Pattern Co., Thomas H. Barkley manager, 207 Brady avenue, Detroit, will build a 1 and 2-story plant and office building 50 x 100 feet.

Ypsilanti Foundry Co., Ypsilanti, Mich., J. H. Lonskey president, East Forest avenue, will build a foundry and core room 100 x 150 feet and 50 x 190 feet.

West Michigan Steel Foundry Co., Muskegon, Mich., now employing 225 men in the manufacture of commercial steel castings and alloys, has installed two new machinery units costing $25,000.

Kankakee Foundry Co., Kankakee, Ill., has been bought by F. A. Schneider, president of the Cartland-Haswell-Rentschler Co., Dayton, O. The plant is equipped to produce gray iron castings.

Contract has been awarded by the Gates Foundry Co., Wilkesbarre, manufacturer of iron and castings, for the erection of a 1-story plant addition, 54 x 100 feet, costing $40,000. Thomas Podmore is architect.

R. & R. Foundry, Newark, N. J., has been incorporated with $30,000 capital by Edgar L. Rankin, Richard J. Rasmuson and Roy Kennedy. Vanderbilt & Hedden, Newark, are attorneys.

Saginaw Products Co., Saginaw, Mich., J. H. Dwight general manager, North Hamilton and Monroe street, will build a 1 and 2-story foundry, the Austin Co., Cleveland, having the general contract.

Conemaugh Iron Works, M. W. Saxman, manager, Latrobe, Pa., is having plans made for rebuilding its burned foundry at Blairsville, Pa., 1-story, 130 x 312 feet. (Noted Nov. 1).

Tarrant Foundry Co., 373 West Grand avenue, Chicago, has bought the plant and business of the Cummins Foundry Co., 1338 Cortland street consisting of a gray iron foundry and pattern shop, which it will continue to operate.

Liberty Foundry Co., St. Louis, W. T. Mellow vice president, 5000 Thirty-eighth street, will build foundry additions, 1-story 90 x 160 feet and 2-story 30 x 90 feet. General contract to the Austin Co., 160 North LaSalle street, Chicago.

Watson Frye Co., Bath, Me., manufacturer of papermill machinery, will enlarge its plant to accommodate the equipment of the Bangor Iron works, Bangor, Me., which it recently bought. The patents, patterns and entire business of the latter were also purchased.

Reading Knob Works, Inc., Reading, Pa., manufacturer of builders hardware, is building an addition to accommodate the plant of the Huber Mfg. Co., 417 East Ninety-third street, New York, which it recently bought and will remove to Reading.

Scully Pattern & Mfg. Co., Cleveland, has been incorporated with $25,000 capital to operate a foundry and machine shop for the manufacture of castings and machinery by John P. Moran, Viola J. Borth, M. Breen, George W. Austin and Harry M. Breen. J. P. Moran, 308 Euclid avenue, is attorney.

Baldt Anchor, Chain & Forge Corp., Chester, Pa., has been incorporated with $100,000 capital in Delaware to take over the plant and business of the Baldt Anchor & Chain Co., which was bought recently by the Boston Iron & Metal Co., Chester. A general foundry and machine shop will be operated.

Pulaski Foundry & Mfg. Corp., Pulaski, Va., is increasing the size of its plant to care for the growing business. The extensions include an addition to the foundry building, provision of another core oven, an air compressor, and 95 feet of additional crane runway over the flask yard. The extension of the foundry building provides a total foundry space of 53 x 205 feet. The capacity of the blacksmith shop and the machine shop also is being increased. The company manufactures medium and heavy castings in gray iron, semisteel and converter steel, and also conducts a pattern shop and a machine shop. W. E. Ring, Pulaski, is manager and Jay J. Seaver, Cleveland, is president of the company.

Replacement of the present plant of the Crucible Steel Casting Co., at 612 Clinton street, Milwaukee, on a new site to avoid interruption of output has been undertaken by the letting of contracts for a new foundry, 134 x 382 feet, at Eleventh avenue and the Chicago & Northwestern main line tracks. The plant is designed by the H. K. Ferguson Co., 4900 Euclid avenue, Cleveland, and will be constructed by W. W. Oeflein, Inc., 86 Michigan street, Milwaukee. The location is adjacent to the plant of the South Side Malleable Co., Fourteenth and Windlake avenues, which is now building an addition 177 x 186 feet, to be ready about the first of December. Walter W. Lange is president of the South Side company and his brother, Albert C. Lange, heads the Crucible company.

Two large plant additions will be commenced immediately by the Richmond Radiator Co., Pittsburgh. The company at present has 1150 men on its payroll and disburses over $1,250,000 annually in wages. With the additions completed, almost 1400 men will be used with an annual payroll of close to $1,500,000. Construction has started on a 40 x 136 foot addition to the enameled ware plant, and a warehouse of 22,000 square feet for the radiator plant will be begun next week. Additional molding circles will be installed during the next six months so that the capacity of the radiator plant will be increased 25 per cent and the enameled ware plant 33 1/3 per cent. The company this month has shipped radiation to every continent, Japan buying the largest foreign consignments.

New Trade Publications

PORTABLE ELEVATORS—Two decades of use of its elevating machinery is sketched in a bulletin by the Revolvator Co., Jersey City, N. J., filled with illustrations of the varied uses to which they have been put.

TAPS AND DIES—A new edition of its small tool catalog has been issued by the Greenfield Tap & Die Corp., Greenfield, Mass., and is being distributed to the trade. Ground thread taps and spiral fluted staybolt taps are listed in this edition and the company's complete line of gages is listed for the first time as well as its bolt and pipe threading machine. A new method of packing screw plates for domestic trade is described.

CONVEYORS—With special emphasis on the principle of the descending spiral the Standard Conveyor Co., North St. Paul, Minn., has issued a bulletin illustrating the use of its various types of automatic conveyors in a number of uses.

LIFTS AND STACKERS—Lewis-Chepard Co., Boston, has issued its annual bulletin of practice with its material handling equipment, Standard and new uses and special adaptations are covered. It suggests further uses of these devices beyond present practice.